25U10/F03LP1
CISCO Routers

Cisco Routers 101 - LP1

- Introduction to Routers
- Configuring the router
- PE: Configuring the Routers hostname & password
- Configuring & Troubleshooting Serial & Ethernet Ports
- PE: Configuring Serial & Ethernet Ports
- Router Protocols and Encapsulation

- LP1

- **In today's information age data moves**
  very fast
- **Implementation of the digital battlefield**

The 25U will be responsible for the bulk of installing, configuring, and maintaining

CISCO Routers 101 - LP1

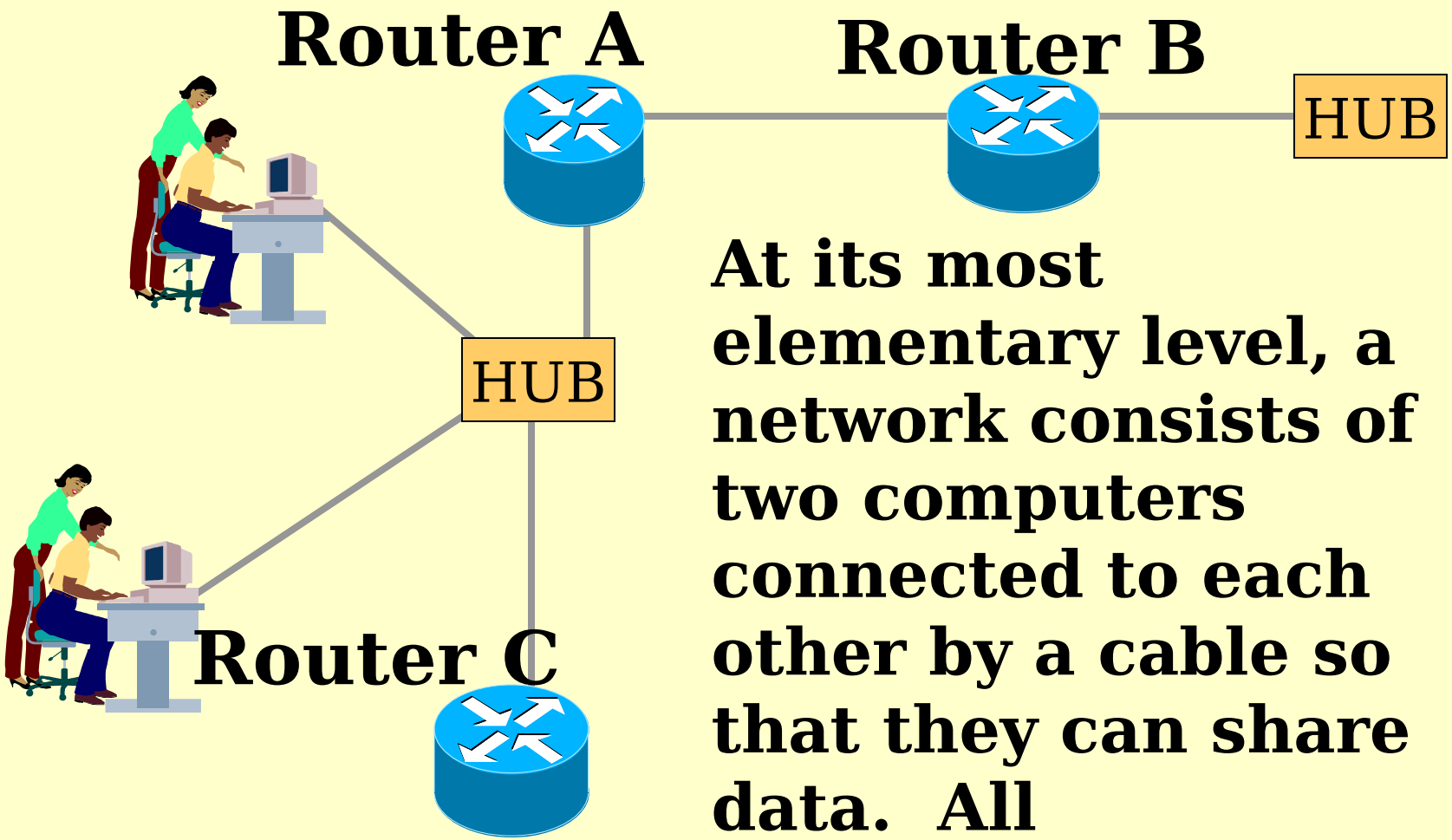
At the completion of this class
you must be able to:

- **Correctly answer 18 out of 25 questions within 30 minutes**
- **Configure and troubleshoot a CISCO Router correctly within 30 minutes**

Introduction to Routers

- Network Concepts
- IP Address & MAC/BIA Addresses
- Packet Construction and the OSI Layers
- Basic Router Functions, Hardware and Commands

Networking Concepts



At its most elementary level, a network consists of two computers connected to each other by a cable so that they can share data. All networking, no

Networking Concepts

egment/Lan = all PC ‘s connected togeth

NIC = Network Interface Card

MAC Address = Media Access Control

BIA Address = Burned In Address

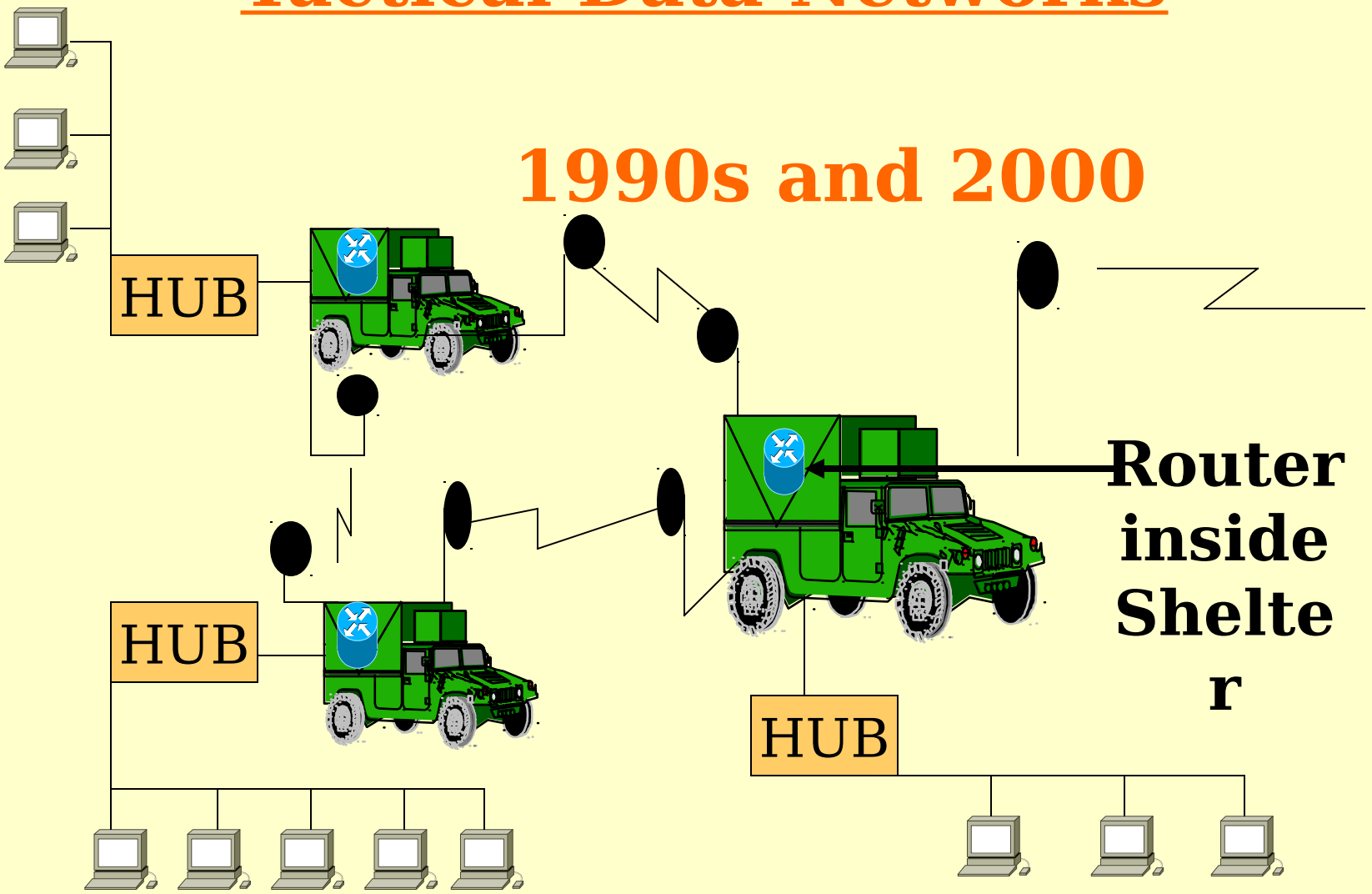
MAC Table = Deals with

Routing Table = Deals with

software

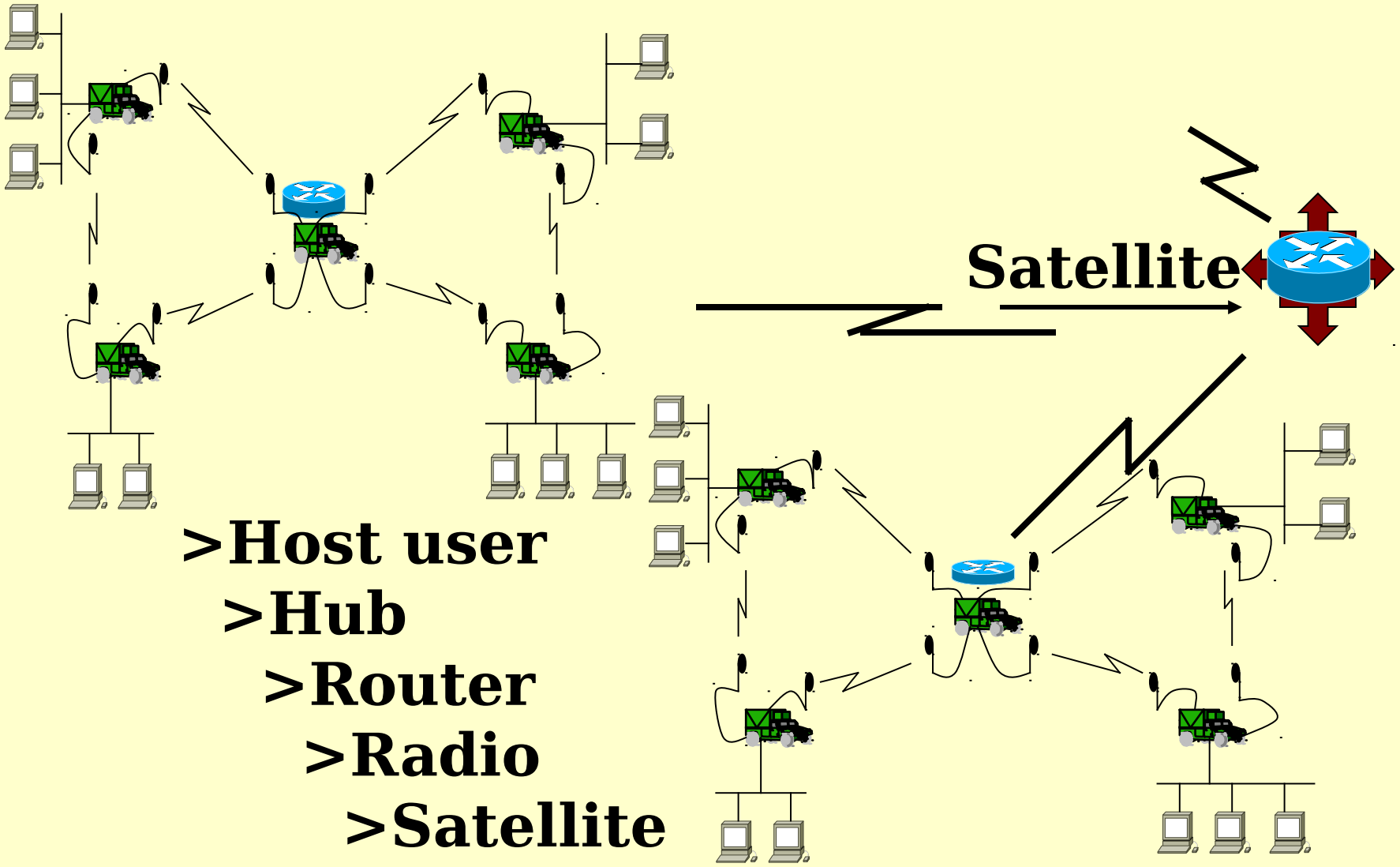
Networking Concepts

Tactical Data Networks



Networking Concepts

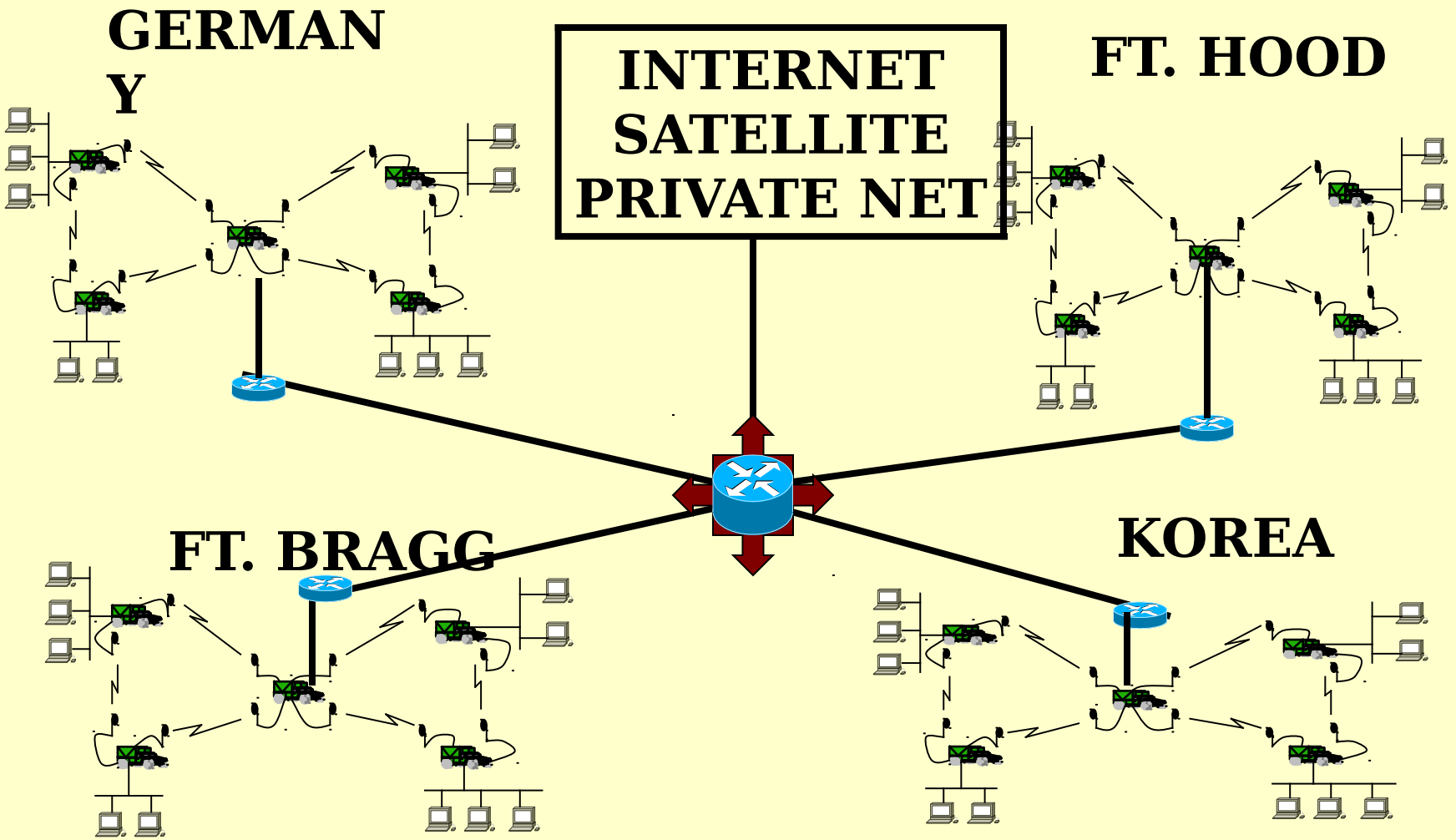
Tactical Data Networks



>Host user
>Hub
>Router
>Radio
>Satellite

Networking Concepts

Tactical Data Networks



IP Address & MAC/BIA Address

IP Addressing: Network and Host

Network addresses consist of a network portion and a host portion.

Both are needed to deliver packets from source to destination.

Routing processes typically are concerned only with the network portion of an address.

This information is required to deliver data to the appropriate network.

Internet Address

Class	Address Structure	Poss
A	Net ID Host ID----Host ID	16,777,214
	125. 25. 16. 52	
	One Octet	
B	Net ID Host ID	65,5
	140. 51. 30. 17	
	Two Octets	
C	Net ID ---- Net ID Host ID	254
	197. 15. 1. 45	
	Three Octets	

MAC / BIA Address

When the destination network has been reached,

the final router in the path uses the host address

portion to send the packet to the appropriate

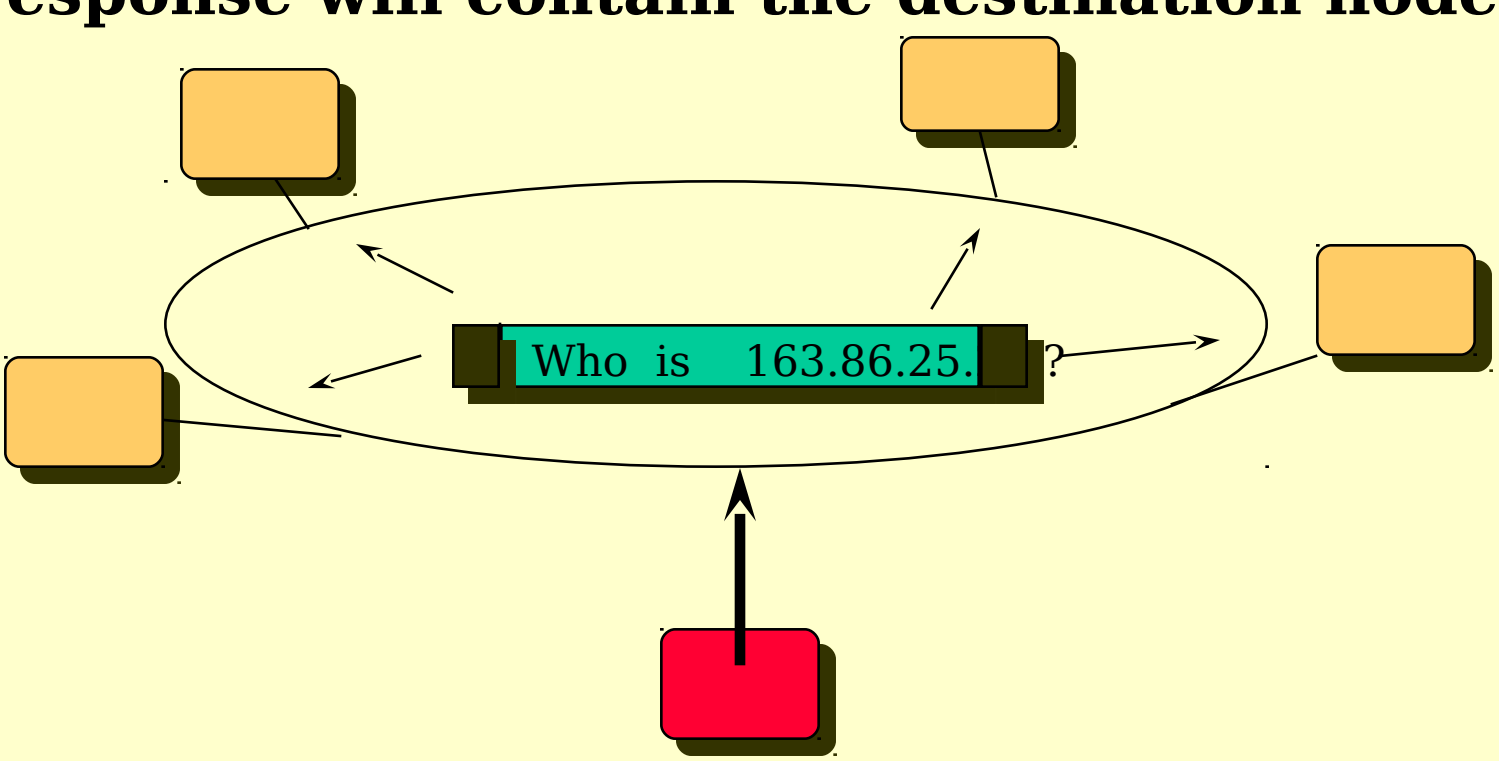
device’s hardware address on the final network

Address Resolution Protocol (ARP)

If a router does not know the MAC/BIA address on t
destination node, it will use a protocol called ARP.

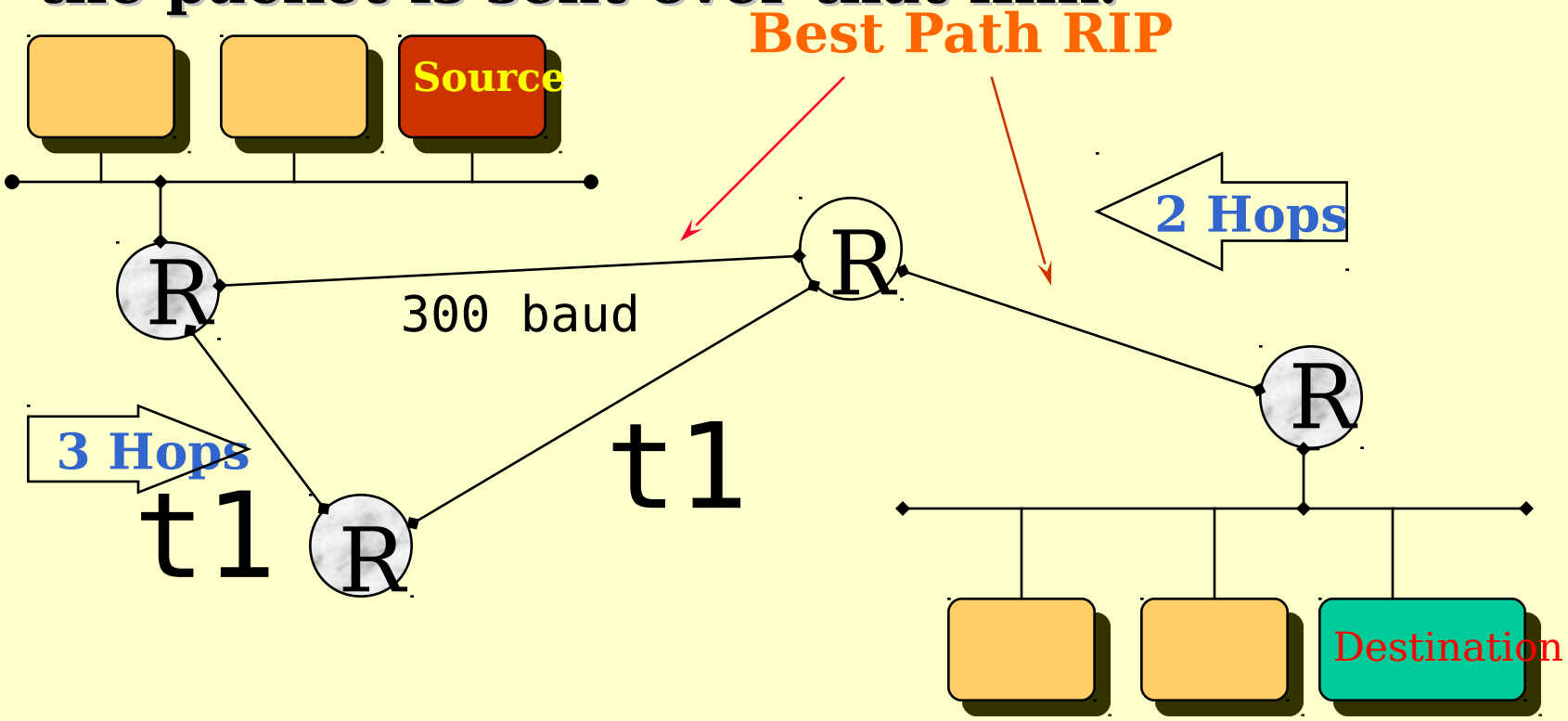
The router will broadcast an ARP request to all node
Only the destination node will return an ARP respo

The response will contain the destination nodes MA



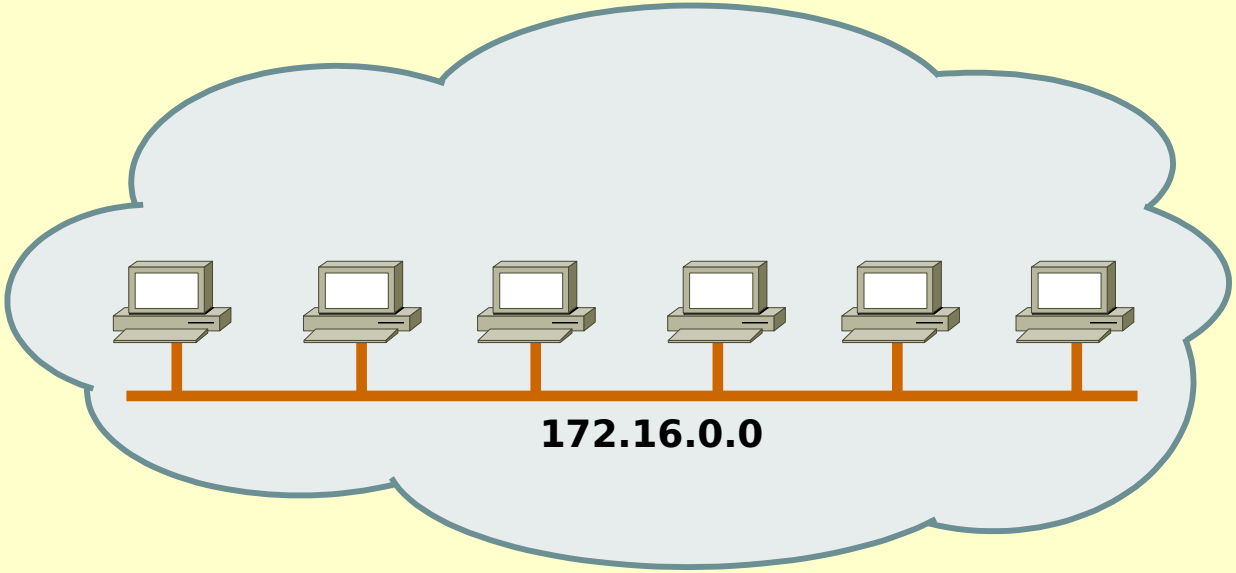
HOW A ROUTER FORWARDS A PACKET

When a router receives a packet, it will read the destination host's network ID in the IP header. The router maintains a table that tells which link is the best path to reach the desired network and the packet is sent over that link.



Subnet Masking

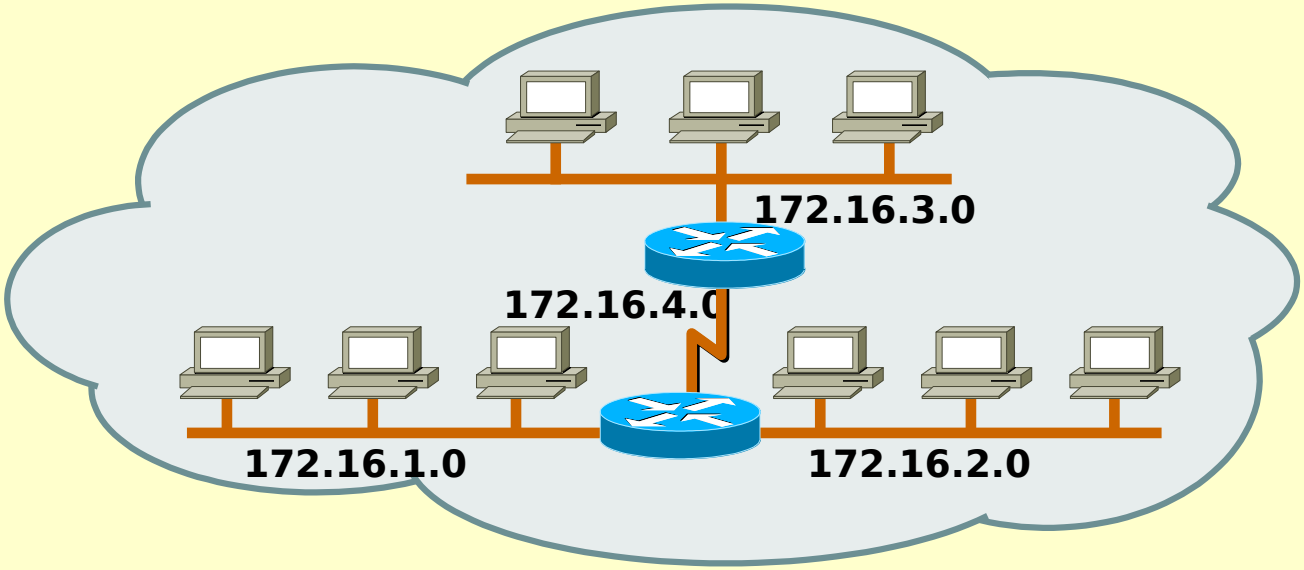
One option of networking is to connect all workstations to one network.



Network 172.16.0.0

Subnet Masking

f you break down the network, you could limit the traffic on the other networks.



Network 172.16.0.0

Check for learning

Where is the MAC / BIA Address locate

It is located on the Network Interface

Where do you get the IP Address?

They are issued by the Network Admin

What are PC’s connected together call

A lan / Segment

Packet Construction and the OSI Layers

- Packet Structure & Components
- Packet Construction
- The OSI Model

The Function of Packets

Data tends to exist as rather large files. However, networks cannot operate if computers put large amounts of data on the cable at one time.

- **Networks reformat large chunks of data into smaller packages in case there is an error in transmission.**

Example: Down loading a picture

Packet Construction

HEADER

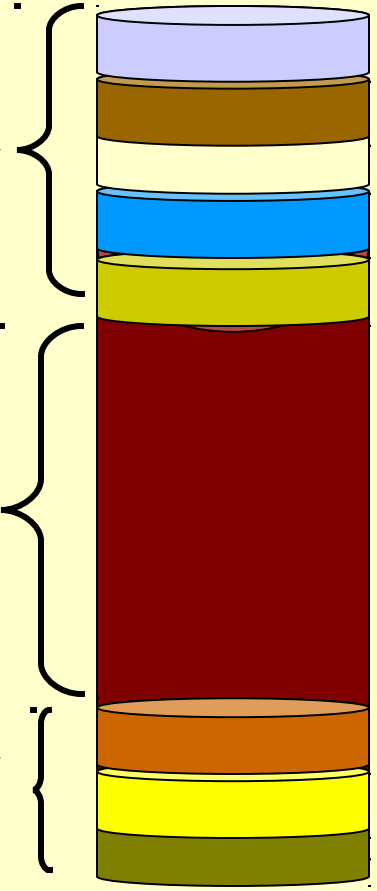
Alert Signal
Source & Destination Address
Clock information

DATA

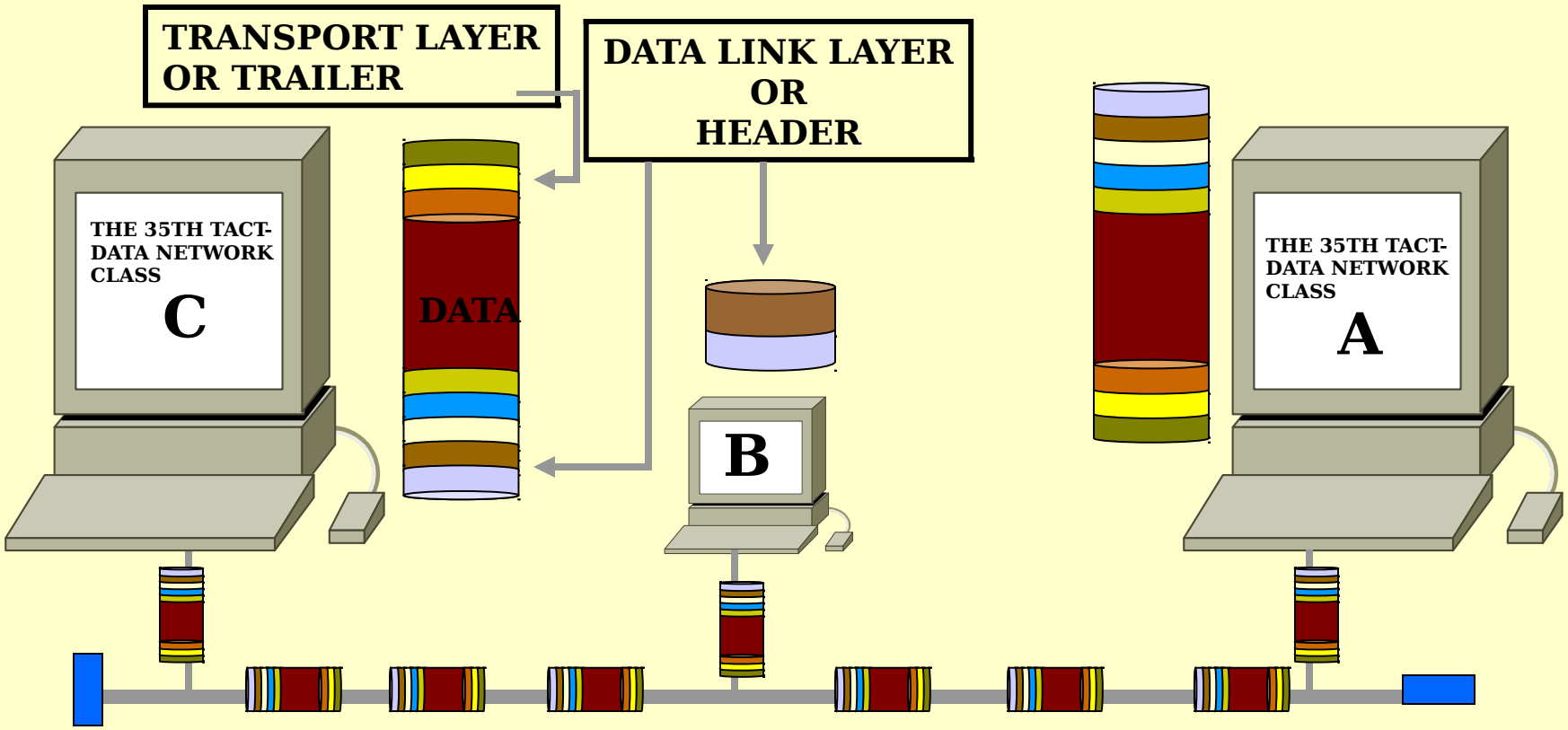
Actual Data Being sent

TRAILER

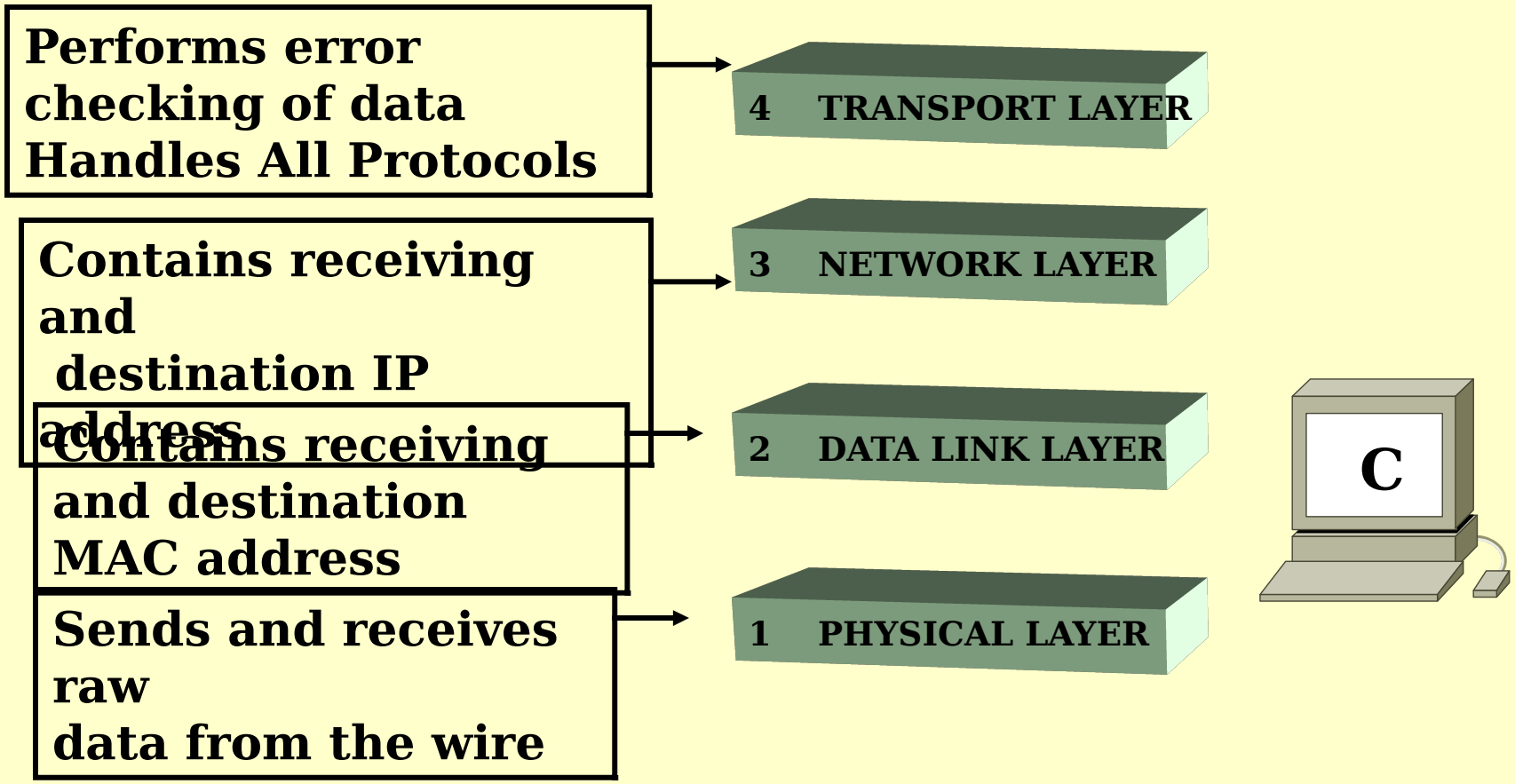
Depends on type of protocol
But usually CRC



PACKET APPLICATION



PACKET APPLICATION


Performs error checking of data Handles All Protocols
4 TRANSPORT LAYER
Contains receiving and destination IP address
3 NETWORK LAYER
Contains receiving and destination MAC address
2 DATA LINK LAYER
Sends and receives raw data from the wire
1 PHYSICAL LAYER
C

Check for learning

What are the three basic parts of a da

he Header, The Data and The Trailer.

hat OSI layer handles almost all protocols

OSI Layer 4 (Transport Layer).

hat OSI layer handles the IP Address?

OSI Layer 3 (Network Layer).

The Router

- Basic Router Functions
- Router Hardware & Softwa
- Router Commands & Oper

Basic Router Functions

A device or computer that forwards traffic between networks or subnetworks.

It operates at the OSI Data Link and Network Layers.

Basic Router Functions

***Functions basically like a computer**

***Routes packets from source to destination**

***Interface between networks**

***Provides a backbone for LAN's, MAN's and**

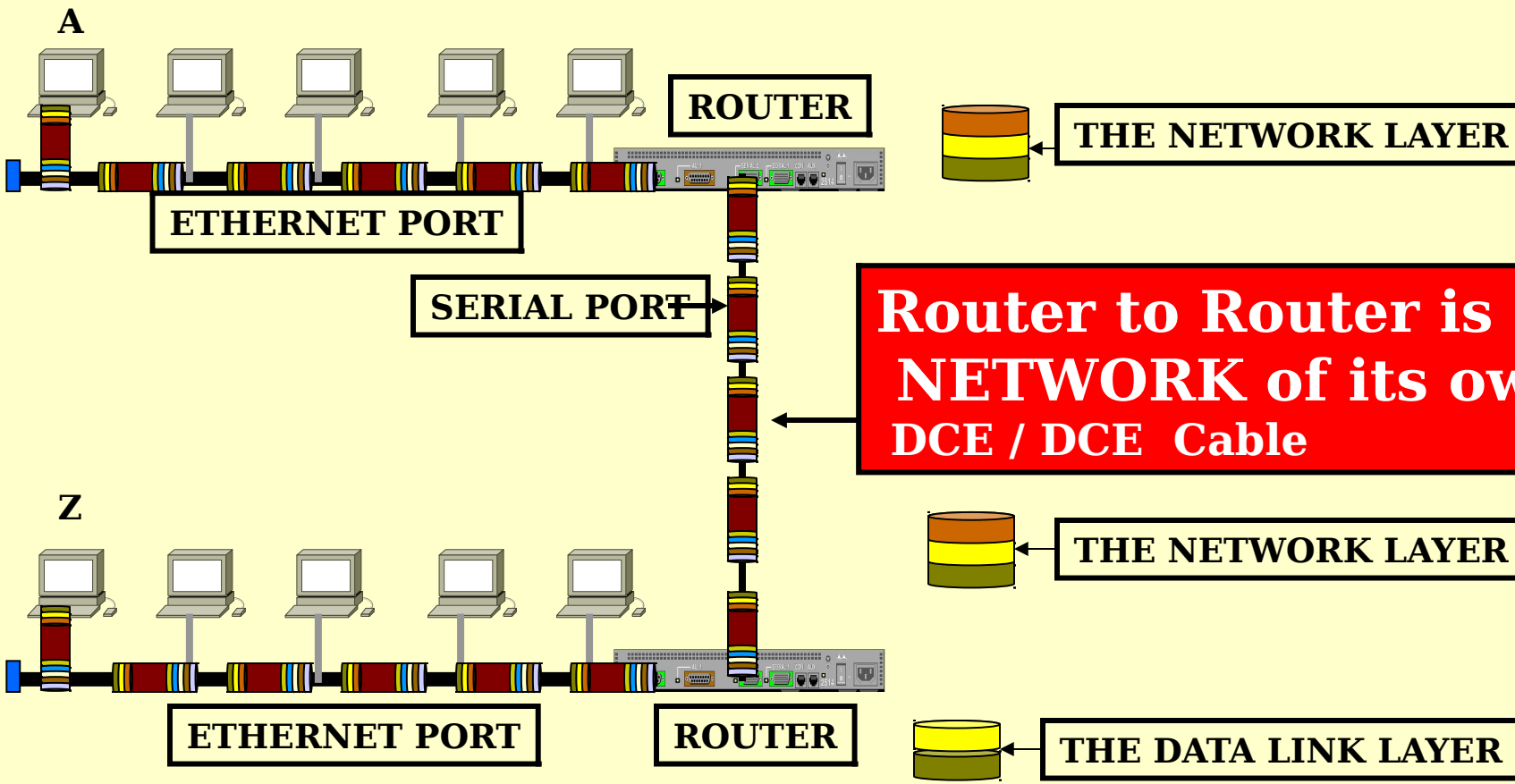
WAN's

***Monitors Link Condition**

***Determines best route for successful**

*** transmission**

Basic Router Functions



DCE / DTE Cable

DCE = Data Communications Equipment

DTE = Data Terminal Equipment

*** Requires an IP address of its own.**

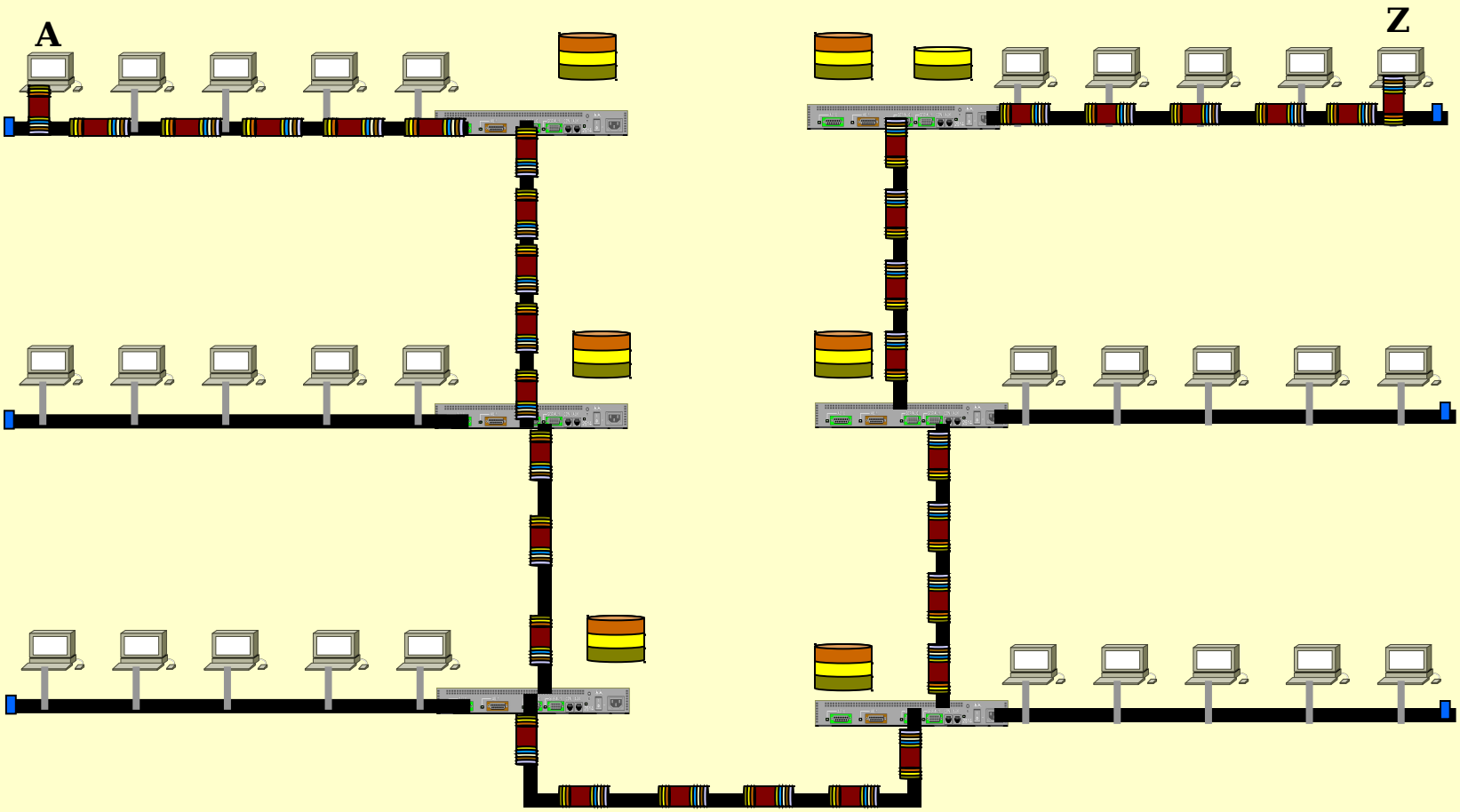
*** Network IP Address**

***2 Host/User IP address (Actually assigned to**

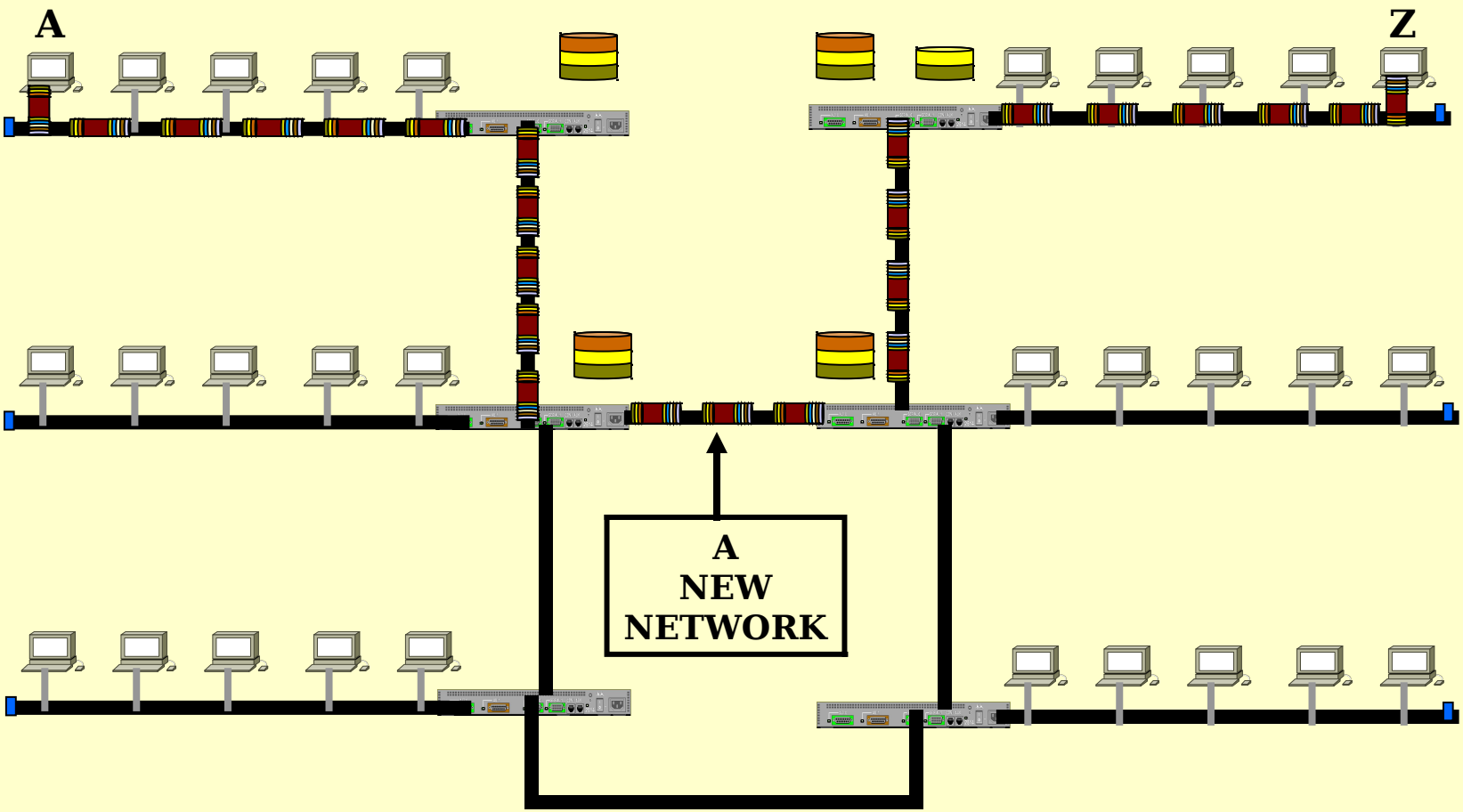
the routers serial ports)

*** Broadcast IP Address**

Basic Router Functions

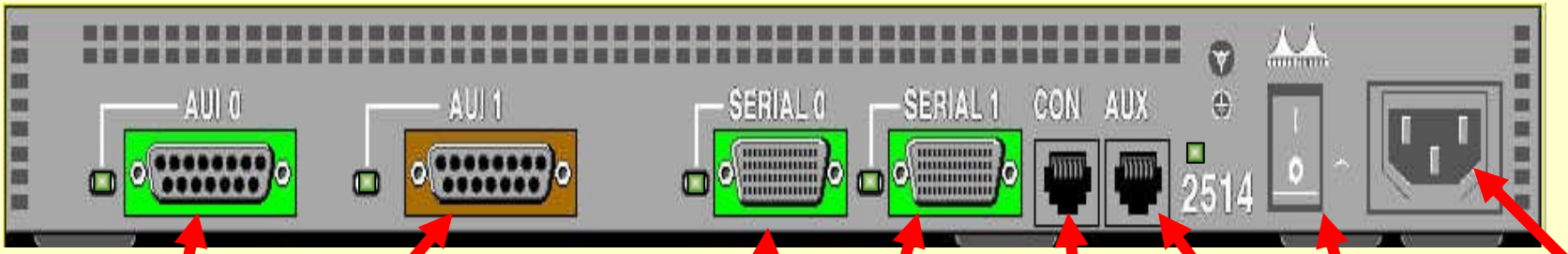


Basic Router Functions



Basic Router Hardware & Software

Router Connections



Ethernet 0 & 1
***AUI (Aux Unit Interface)**
***Connects to Hubs or Users**
***Support more than 1 Protocol**

Serial 0 & 1
***High Density DB60**
***Connects router to router or**
***Other transmission device**
***Higher speed than Ethernet Port**

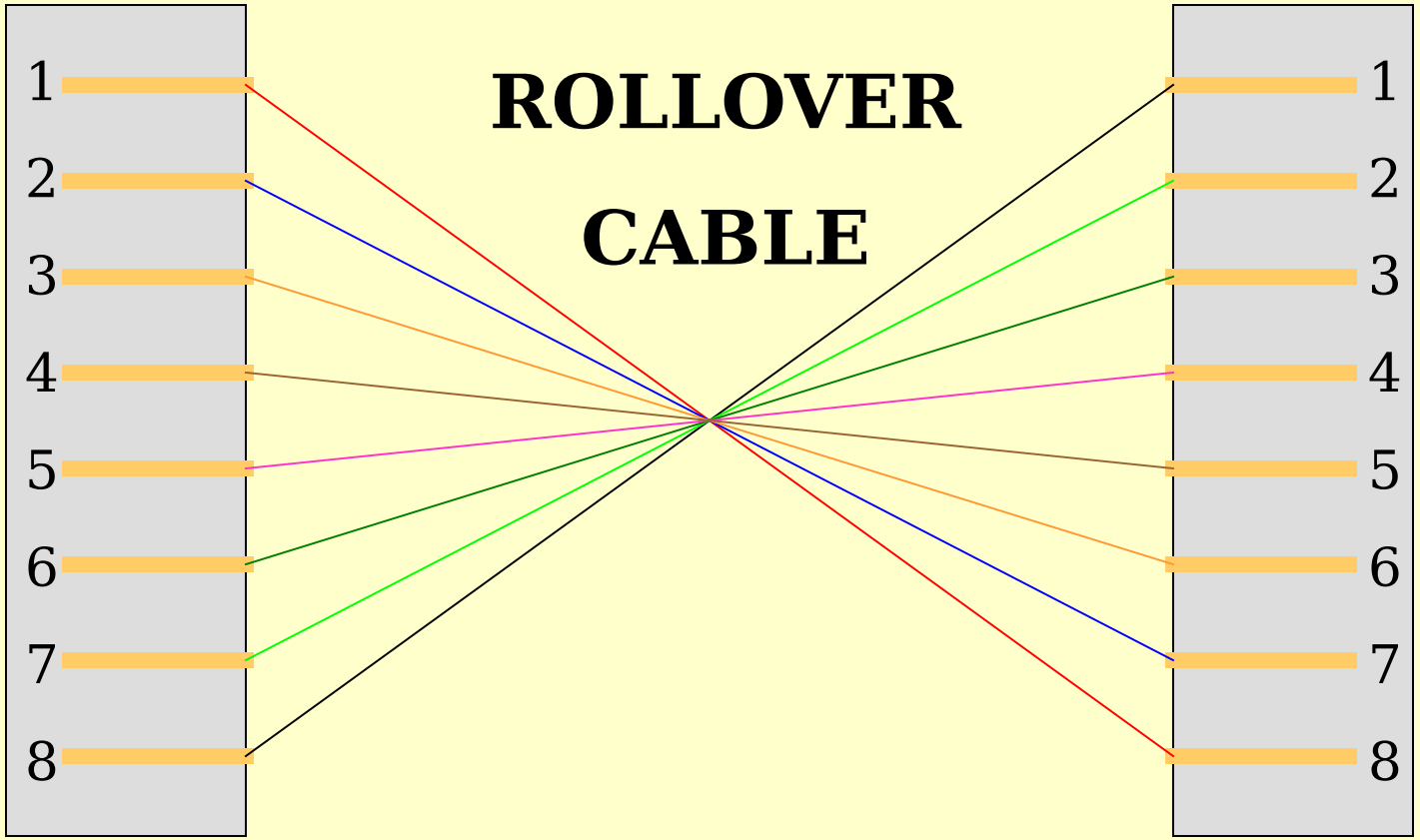
Console Port

Auxiliary Port

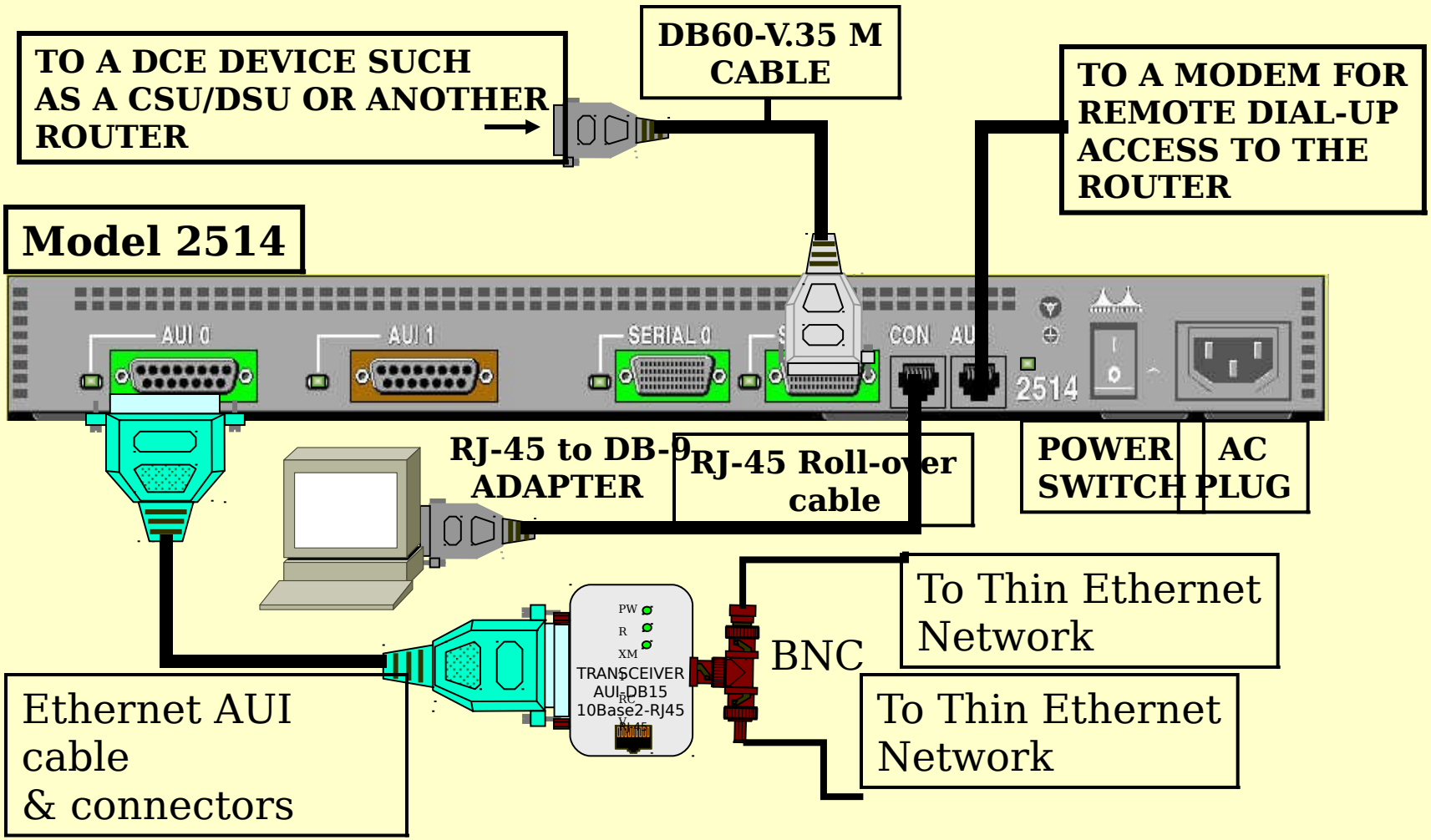
Power switch plug in

Basic Router Commands & Operation

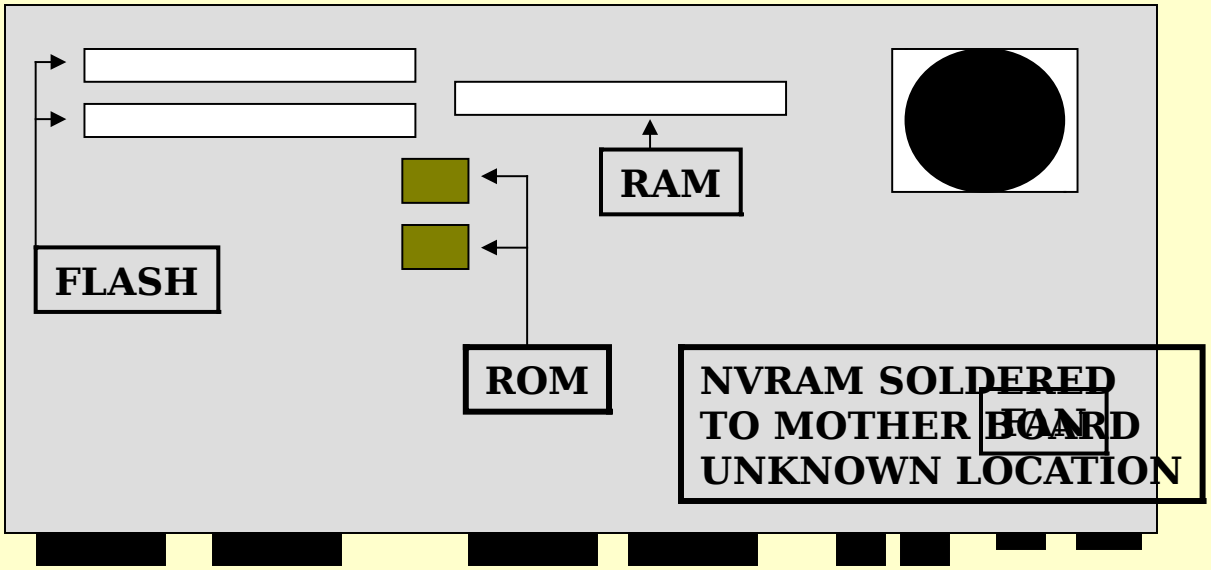
Accessing the router



Basic Router Hardware & Software



Basic Router Hardware & Software



ROM-32K BYTES:CONTAINS AN INITIALIZING BOOTSTRAP PROGRAM USED TO RECOVER FROM A CATASTROPIC FAILURE

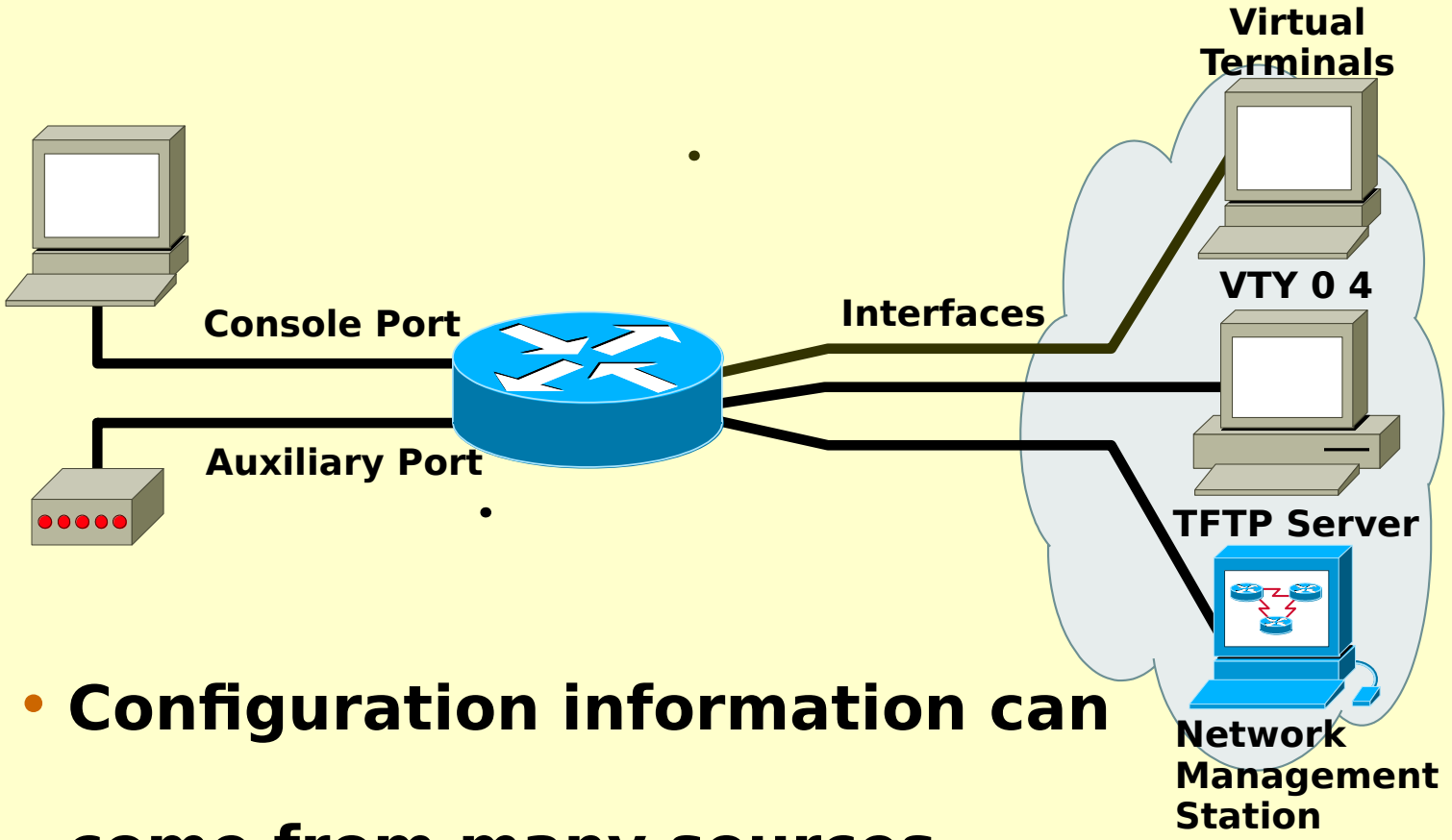
FLASH-8MEG EEPROM: CONTAINS A COPY OF THE CISCO INTERNET WORK OPERATING SYSTEM

RAM-1MEG:IS THE WORKING STORAGE, USED TO PERFORM ROUTER TASKS

NVRAM 32K BYTES:CONTAINS A BACKUP COPY OF YOUR CONFIGURATION

Basic Router Commands & Operation

Accessing the router



- Configuration information can come from many sources

Basic Router Commands & Operation

Accessing the router

Routers have a text base interface.

They are Accessed using a terminal application, such as “Procomm” or “Hyper-Terminal.”

Using this application, routers can be accessed remotely as well as locally

Basic Router Commands & Operation

Accessing the router

After connecting the workstation to the console connection, HyperTerminal must be configured to the router's interface.

Data configuration for the HyperTe

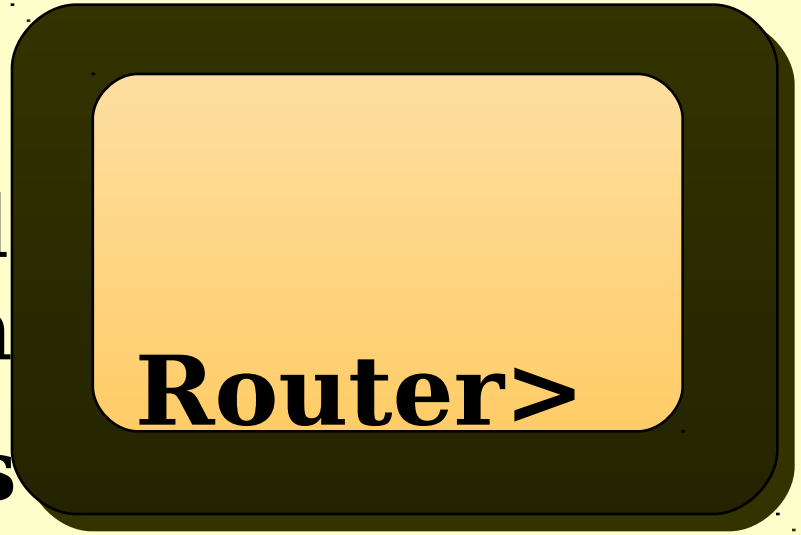
- **9600 bits per second**
- **8 bit data rate**
- **1 stop bit rate**
- **Hardware flow control**

Basic Router Commands & Operation

Router Modes

User EXEC:	**Router>**
Privileged EXEC:	**Router#**
Global Configuration:	**Router(Co**

User EXEC Mode



You enter this mod after initial log-on

Limited commands examination of the Router

Remote Access to other Routers

Privileged EXEC Mode

Detailed examinatio
of the Router.

Troubleshooting,
Debugging and Tes

File manipulation

Remote Access to other Routers

Global Configuration Mode

ONLY mode that you can make changes to your router!!!!!!!!!

Simple configuration commands.

One command lines

Basic Commands

Command	What the command is used for
en	Enter the privilege exec mode
config t	Allows global configuration
exit	Takes you down one level
<Ctrl> Z	Takes you to first level
wr mem	Writes changes to

Verification & Troubleshooting Commands

Command	What the command is used for
sho run	Shows router status & setup
sho ip route	Shows router tables
sho int s0	Shows serial port configuration
sho int e0	Shows Ethernet

Verification & Troubleshooting Commands

Command	What the command is used for
Ping	echo message from 1 IP to another
Telnet	Remote access to another router
Traceroute	Identifies all devices from one

Check for learning

What OSI layers are the routers concerned a

yer 2 (Data Link) and Layer 3 (Network).

What command will put the router into the EXEC mode?

en or enable.

t Command will show the router table informa

sho ip route.

What are the 3 modes of the router?

User Exec, Privilege Exec, Global Config

CONFIGURING THE ROUTER

The startup-configuration file (startup-config) is saved in NVRAM to allow for automatic boot-up

If no configuration file is found in NVRAM the router enters the SETUP mode

CONFIGURING THE ROUTER

BEFORE AN EXISTING CONFIGURATION CAN BE CREATED,LOADED,OR ALTERED,YOU MUST BE IN THE GLOBAL CONFIGURATION MODE

THE *configure terminal* COMMAND IS USED THE MAKE CHANGES TO THE RUNNING-CONFIGURATION FILE

ONCE A COMMAND HAS BEEN EXECUTED, IT TAKES EFFECT IMMEDIATELY

CONFIGURING THE ROUTER

TO ENTER THE GLOBAL CONFIG MODE YOU MUST USE THE (config t)COMMAND

```
Router>ena
Router# config t
Router (config)#
```

CONFIGURING ROUTER IDENTIFICATION

THE FIRST TASK IN CONFIGURING A ROUTER IS TO GIVE IT A NAME

NAMING YOUR ROUTER HELPS YOU TO BETTER MANAGE YOUR NETWORK BY UNIQUELY IDENTIFING EACH ROUTER WITHIN THE NETWORK

THE NAME THAT IS GIVEN TO THE ROUTER IS CALLED THE *HOST NAME* AND IS THE NAME DISPLAYED AT THE SYSTEM PROMPT

CONFIGURING ROUTER IDENTIFICATION

"hostname" **command is used to change the routers prompt.**

- **The Default HOSTNAME is *Router>***
- **This command is used in the Global Command.**

```
ROUTER(CONFIG)#hostname ROUTER1
ROUTER1(CONFIG)#^Z
ROUTER1#WRITE MEMORY
```

CONFIGURING A BANNER

"banner" COMMAND IS USED TO DISPLAY INFORMATION TO USERS AS THEY LOGIN.

REQUIRES:

- **MESSAGE OF THE DAY (MOTD) ATTRIBUTE**

- **A SYMBOL IS USED AT THE START AND END OF THE COMMAND.**

CONFIGURING A BANNER

ROUTER1(CONFIG)#*banner motd #*
(Enter)

FOR OFFICIAL USE ONLY……
(Enter)

#
(Enter)
<CTRL><Z>

ROUTER PASSWORDS

CISCO ROUTERS HAVE FOUR TYPES OF PASSWORDS:

(Login & User exec mode))

-CONSOLE PASSWORD

(Telnet)

-VIRTUAL TERNINAL PASSWORD

(Privilege exec mode)

-ENABLE PASSWORD (Plain text)

-ENABLE SECRET (Encrypted text)

ROUTER PASSWORDS

ROUTERS CAN BE SECURED BY THE USE OF PASSWORDS TO RESTRICT ACCESS

PASSWORDS CAN BE ESTABLISHED BOTH ON INDIVUAL LINES AND TO THE PRIVILEGED EXEC MODE

PASSWORDS ARE CaSe SENSITIVE

PASSWORD CONFIGURATION (CONSOLE PASSWORD)

THE line console 0 LOGIN PASSWORD ESTABLISHES A LOGIN PASSWORD ON THE CONSOLE TERMINAL (USER MODE)

SET INDEPENDENTLY FROM OTHER PASSWORDS

```
router(config)#line console 0
router(config-line)#login
router(config-line)#password router
router(config-line)#<CTL><Z>
```

CONFIGURATION

(VIRTUAL TERMINAL PASSWORD)VTY 0 4

THE *line vty 0 4* LOGIN PASSWORD ESTABLISHES A LOGIN PASSWORD ON INCOMING TELNET SESSIONS

THE SAME PASSWORD CAN BE USED FOR ALL FIVE LINES or NOT

THIS PASSWORD MUST BE SET FOR REMOTE CONFIGURATION SUPPORT

```
router(config)#line vty 0 4
router(config-line)#login
router(config-line)#password router
router(config-line)#<CTL><Z>
```

PASSWORD CONFIGURATION (ENABLE PASSWORD)

THE *enable password* COMMAND RESTRICTS ACCESS TO THE PRIVILEGED EXEC MODE

WHOEVER HAS THIS PASSWORD CAN DO ANYTHING WITH THE ROUTER

USE THE ENABLE PASSWORD WHENEVER POSSIBLE

router(config)#*enable password ROUTER*

router(config)#*<CTL> <Z>*

(ENABLE SECRET PASSWORD)

PERFORMS THE SAME FUNCTIONS AS THE ENABLE PASSWORD BUT WITH IMPROVED ENCRYPTION

IF CONFIGURED, IT IS USED INSTEAD OF THE ENABLE PASSWORD, NOT IN ADDITION TO IT

```
router1(config)#enable secret ROUTER
```

Saving & Verifying Configuration Changes

In order to save your configuration you will need to type <CTL> Z and wr mem or copy run start.

```
Router>enable
router#config t
router(config)#hostname student
student(config-if)#<CTL> <Z>
student# wr mem or copy run start
student#show run
```

Check on Learning

hat type of cable is used to access the router?

Rollover cable

at mode will the command en put the router in

Privilege exec mode

What command will enable the Global con mode?

Config t

hat do we call the name that is given the route

Hostname

ow many different passwords can the router ha

Four

P E # 1

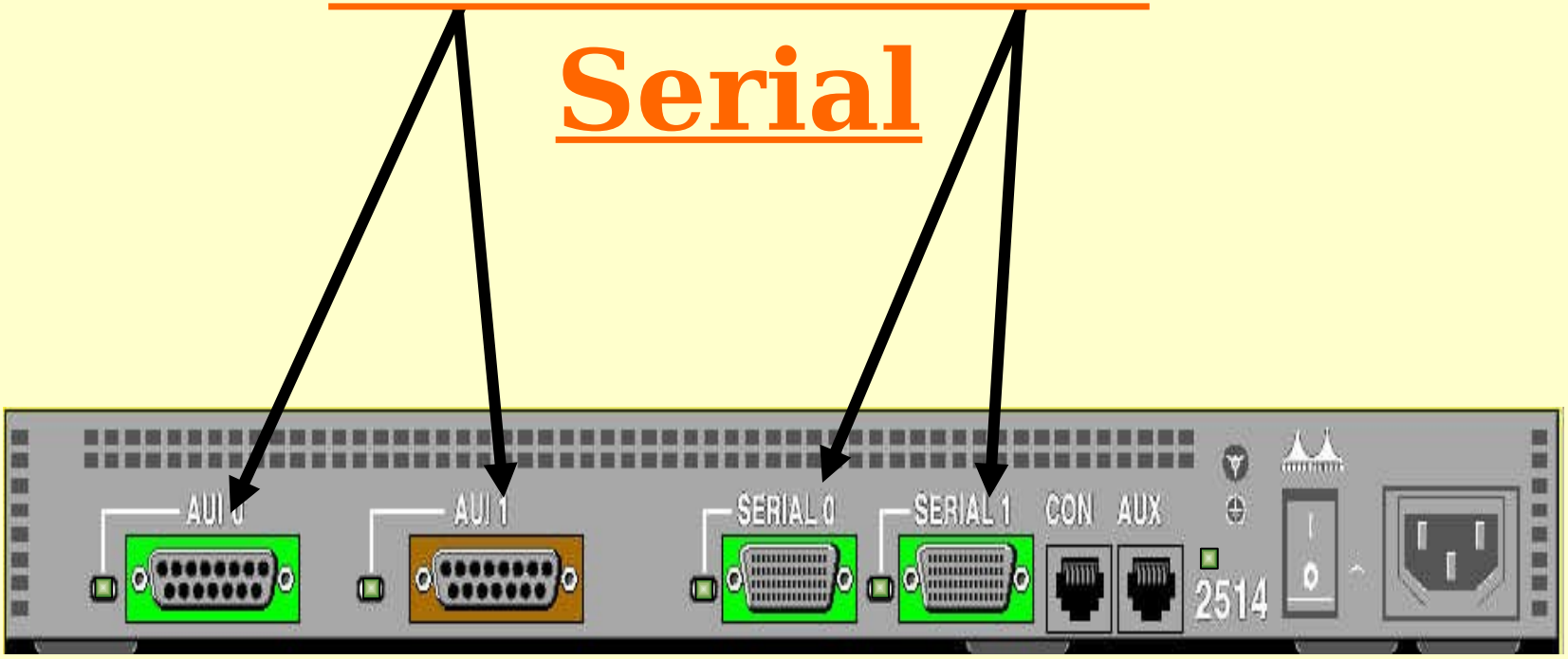
Hostname

&

Passwords

Configuring Interfaces

Ethernet and Serial



Conference Demonstration

CONFIGURING INTERFACES

In order to relay packets from one router to next router, the interface of each router should be configured with the following information.

This configuration includes, but is not limited to:

Must Have:

Port Address

Encapsulation

Optional:

Cable Description

Clock Rate (DCE Only)

Bandwidth

DETERMINING DCE / DTE STATUS

On serial links, one side is DCE, the other is DTE.

Cisco routers are DTE by default, but can be configured as a DCE device.

With NO modem or other attached device that provides a clock rate, the router acting as a DCE device must provide a clocking signal.

Use the *show controllers* command to verify if the interface is DTE or DCE.

Example: router#*show controllers s0* or *s1*

DESCRIPTION COMMAND

The *DESCRIPTION* command helps you remember specific information about complex configurations.

Example:

router1(config-if)*# description* this interface is *dce* or *date*

CONFIGURING INTERFACES

A serial interface can be configured from the console or through a VTY line.

Enter the Global configuration mode, and identify the interface to be configured.

Determine if the interface is DTE or DCE, if DCE a clock rate must be specified.

Specify the desired bandwidth.

CONFIGURATION COMMANDS

THE IP ADDRESS COMMAND:

Establishes the IP Address of an interface / port.

Specifies the subnet mask for that interface / port.

Each active interface / port must have an IP Address and subnet mask.

EXAMPLE:

```
router(config)#interface s 0  or  s 1
router(config-if)#description dce or dte
router(config-if)#ip address 192.50.100.5
   255.255.255.252
```

NO Shutdown

The NO shutdown command is used to tell the router to OPEN the port that is currently being configured. Must be done on each individual port.

```
router(config-if)# no shutdown
```

Configuring a Serial Interface

```
Router>enable
router#config t
router(config)#interface s 1
router(config-if)#description dce  or  dte
router(config-if)#ip address 192.50.100.5
   255.255.255.252
router(config-if)#no shutdown
router(config-if)#bandwidth 256
router(config-if)#clock rate 64000
router(config-if)#encapsulation ppp
router(config-if)#<CTL> Z
router#
```

Configuring a Ethernet Interface

```
router>enable
router#config t
router(config)#interface e 0  or  e 1
router(config-if)#ip address 192.50.100.5
   255.255.255.252
router(config-if)#no shutdown
router(config-if)#<CTL>Z
router#
```

Saving & Verifying Configuration Changes

```
router(config-if)#<CTL> <Z>
router# wr mem or copy run sta
router#show run
```

Troubleshooting

The router constantly monitors the link status of all connections.

The router will tell you when a line goes up or down.

This will only show the status of directly connected networks

Troubleshooting

sho run: this will give you a quick reference of your basic router setup.

If you are unsure about correct IP Addressing and Subnet Masking, this is a good place to look.

sho int s0: If there are problems with Serial ports.

sho int e0: If there are problems with Ethernet ports.

telnet: allows a remote access into a router.

Only works if the specified router is setup for this mode and you have a communication with

Troubleshooting

ping: sends the signal to the destination device and waits for a reply.

trace route: show you the route a packet uses to reach a specified destination.

sho ip route: shows the routing table with all networks in the area and link type.

This will not show networks outside of your OSPF area

ERASING

The "Erase" command is used to erase the configuration file stored in NVRAM.

It will also cause SETUP to start on restart.

Erase startup-config or write erase

Example:

router#erase startup-config

or

router#write erase

Check on Learning

What command shows the status of serial p

sho int s 0.

What command shows the status of Etherne

sho int e 0.

What command can give you remote access router?

telnet.

What command is use to verify the type of serial cable connected to our router?

sho controller s 0 or s 1

Check for learning

What cable requires a clock rate?

DCE

What command is used to save configuration changes?

Wr mem or copy run start

What command must be typed to open a interface?

No Shutdown

me two method to configure a interface?

Locally (console port), Remotely (aux port)

P E # 1 Must be completed before you can do P E # 2

P E # 2

Configuring Interfaces

Basic

I P Routing

Protocols

Cisco Discovery Protocol (CDP)

CDP is a single proprietary command

CDP enables you to access a summary of the protocols and addresses configured on other Cisco devices.

CDP is protocol independent.

CDP runs on all Cisco equipment, including-

- **Routers, Access servers, Workgroup switches**

CDP Commands

CDP is enable by default at the global level and on each interface in order to send or receive CDP information.

- **To disable at the global level**
  - **Router(config)#no cdp run**
- **To disable on a specific interface**
  - **Router(config-if)#no cdp enable**

CDP Commands

show cdp interface

show cdp neighbors

show cdp neighbors detail

show cdp entry *device-name*

Static versus Dynamic Routes

Static route

- **Uses a protocol route that a network administrator enters into the router**

Dynamic route

- **Uses a route that a network routing protocol adjusts automatically for topology or traffic changes**

ADMINISTRATIVE DISTANCE DEFAULTS

Connected Interface	0
Static Route	1
RIP	120
IGRP	100
EIGRP	90
OSPF	110
BGP	20

Sho ip route

PRIVILEGED EXEC - SHOW IP ROUTE

router#sho ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
U - per-user static route, o - ODR

Gateway of last resort is not set

148.43.0.0/16 is variably subnetted, 7 subnets, 2 masks
C 148.43.200.103/32 is directly connected, Loopback0
O 148.43.200.101/32 **[110/455]** via 148.43.200.106, 02:33:13, Serial1
C 148.43.200.106/32 is directly connected, Serial1
B 148.43.200.20/30 **[20/0]** via 148.43.200.18, 06:47:45
C 148.43.200.18/32 is directly connected, Serial0
C 148.43.200.16/30 is directly connected, Serial0
B 148.43.200.28/30 [**20/0**] via 148.43.200.18, 04:06:19

tatic Routing Characteristics

Administration and configured manually.

The Administrator must manually update the static route entries whenever the internet work topology changes.

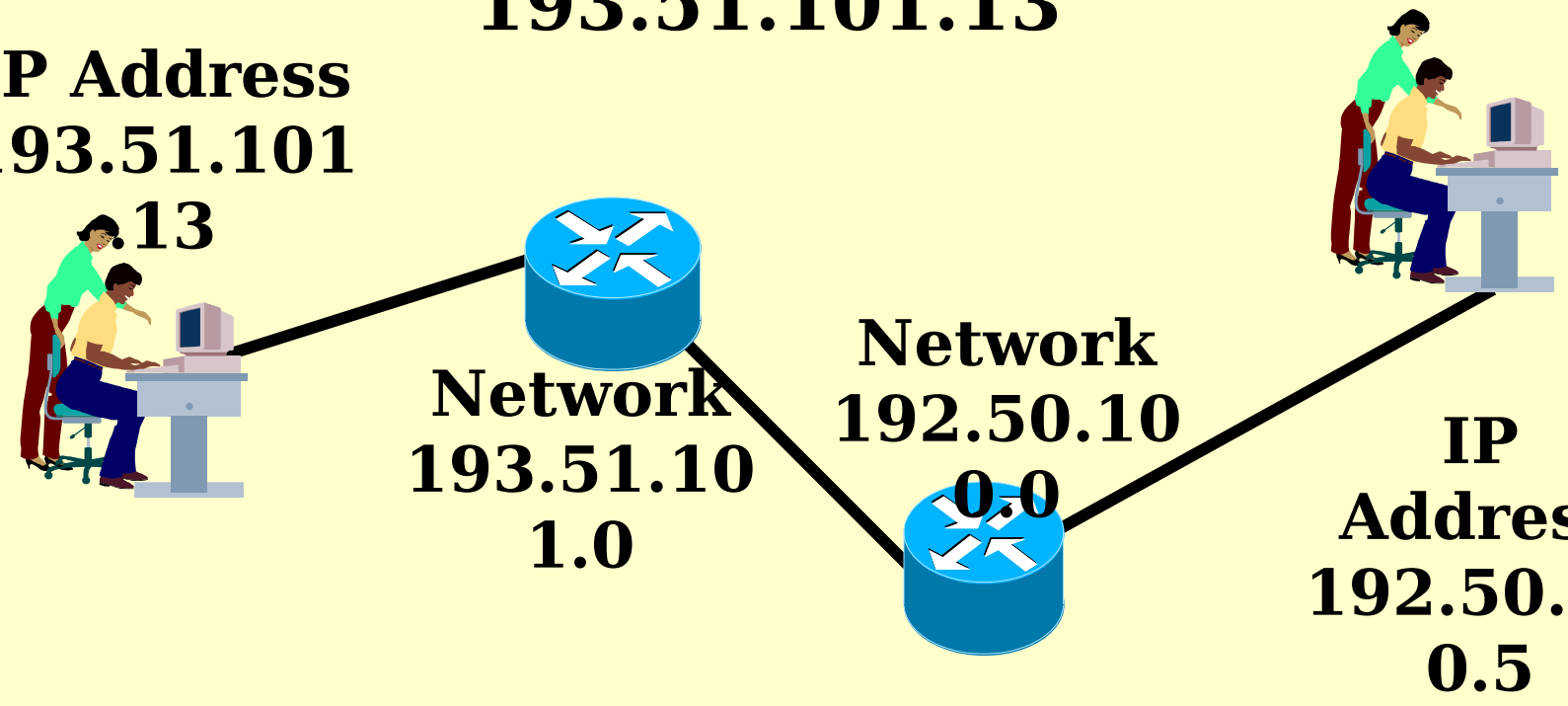
Are required when security is required or

for stand alone routing to the outside world.

Static Routing

Router(config)#

ip route 192.50.100.0 255.255.255.0 193.51.101.13



Different Routing Proto

- RIP **Routing Information Protocol; distance vector type, open**
- IGRP **Interior Gateway Routing Protocol; distance vector, Cisco Proprietary**
- OSPF **Open Shortest Path First; link state type, open**
- EIGRP **Enhanced IGRP; balanced hybrid type, Cisco Proprietary**

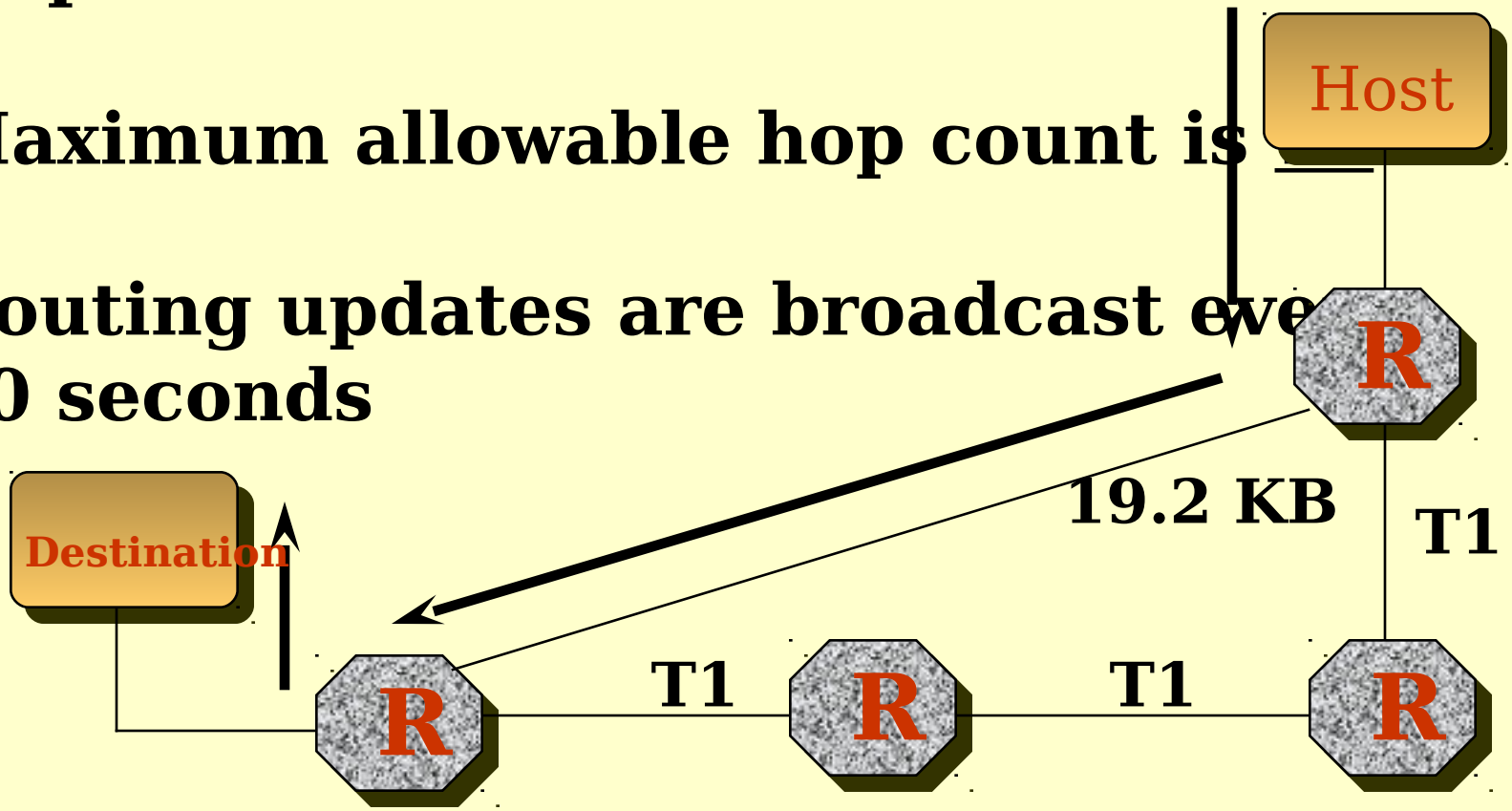
Routing Information Protocol (RIP)

A distance vector routing protocol

Hop count is used as the metric

Maximum allowable hop count is 15

Routing updates are broadcast every 30 seconds



RIP Configuration

Router (config)# Router rip

Starts the RIP routing pr

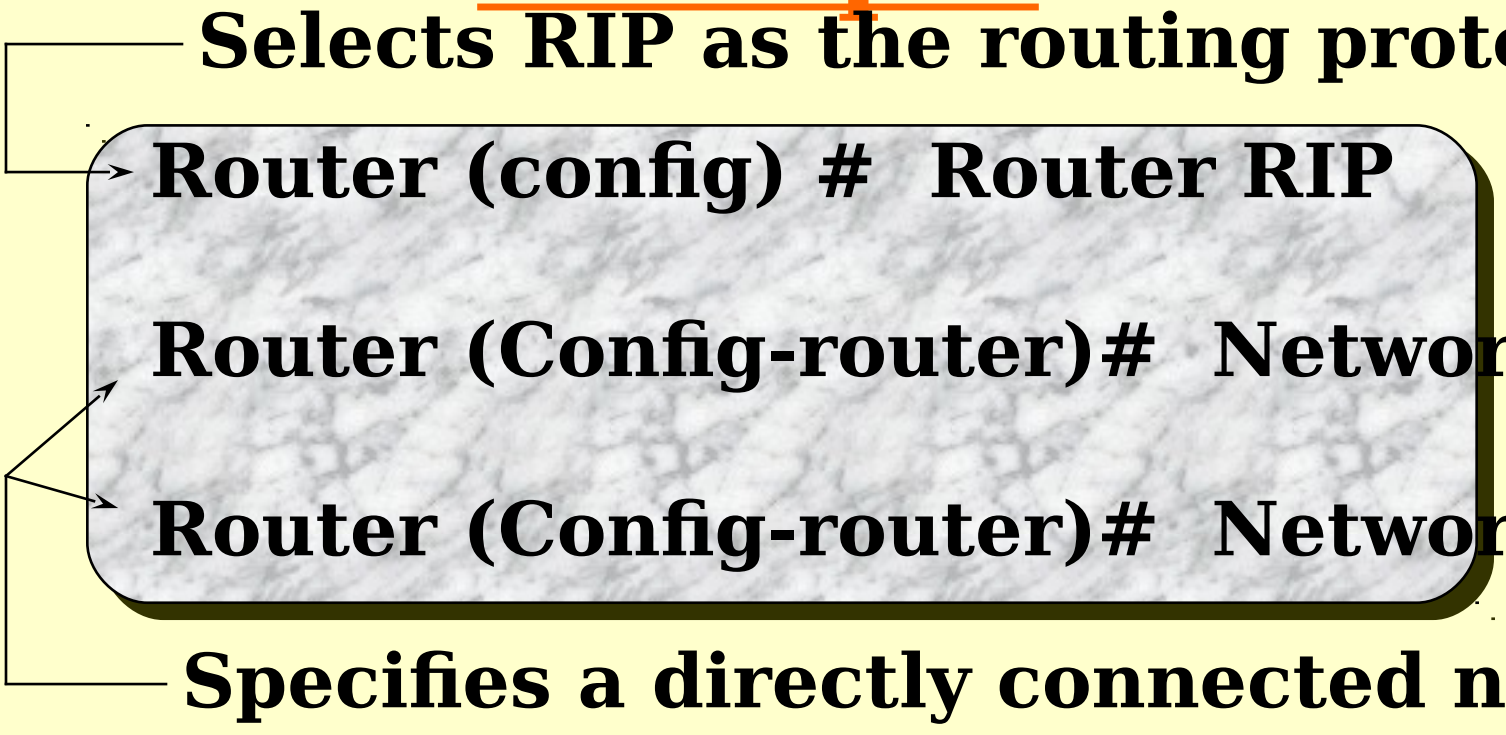
Router (config-router) # Network number

Selects participa attached networ

The Network command assigns a NIC-based address to which the router is directly connected.

The routing process will associate interfaces with the proper addresses and will begin packet

RIP Configuration Example


Selects RIP as the routing protocol
Router (config) # Router RIP
Router (Config-router)# Network 1.0.
Router (Config-router)# Network 2.0.
Specifies a directly connected networ

The Cisco Router interfaces, connected to networks 1.0.0.0 and 2.0.0.0, will send and receive RIP updates. These routing updates allow the router to learn the network topology.

Routing RIP

“Show IP Route” command is used to display contents of tables listing info about the networks, and subnet works.

View the codes that show how the info was learned (RIP, IGRP)

Routing RIP

“Show IP Protocol” command is used to display info about routing timers, filters, and network information

P E # 3

Configuring Serial Interfaces with

RIP as the

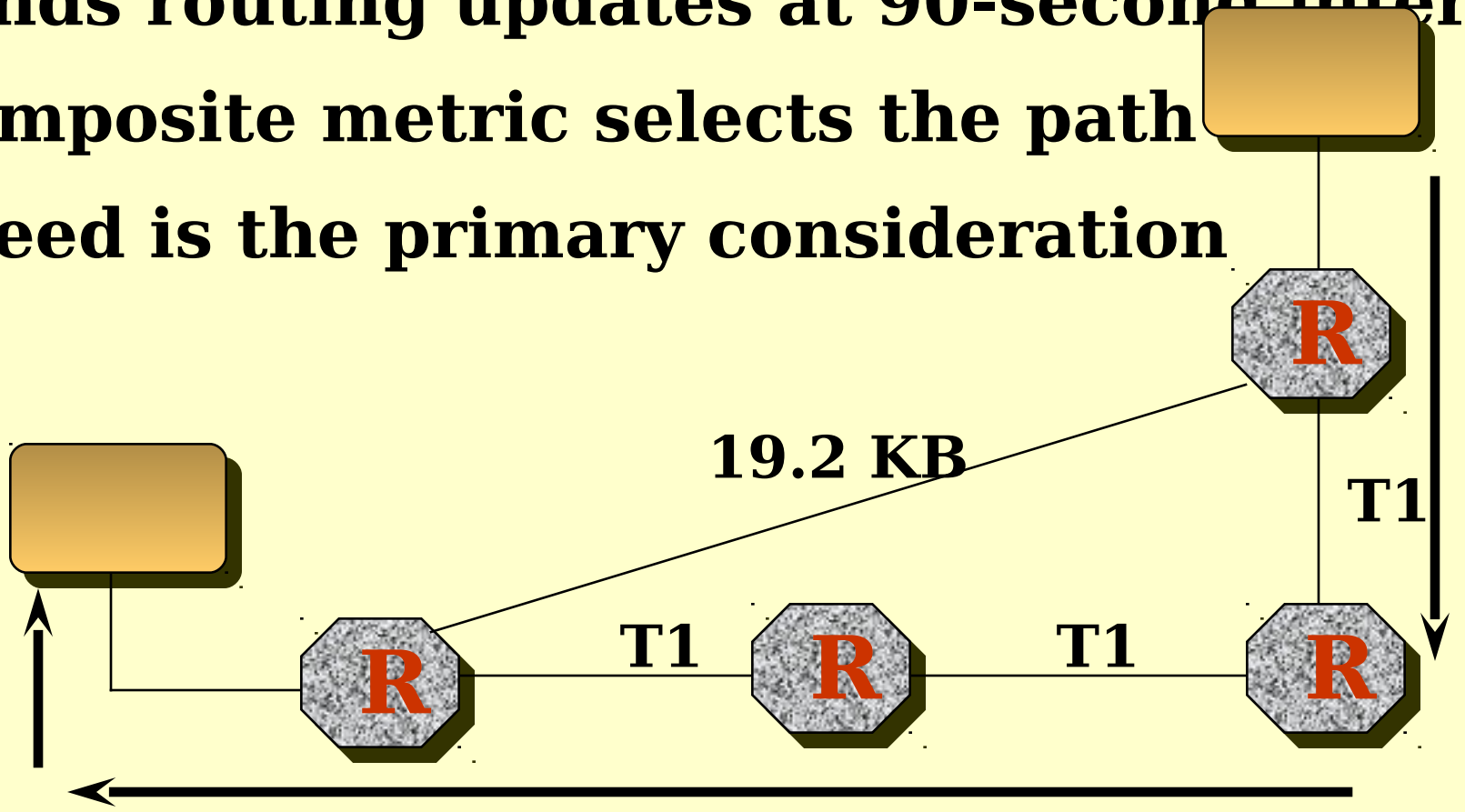
Interior Gateway Routing Protocol (IGRP)

A distance-vector routing protocol

Sends routing updates at 90-second intervals

Composite metric selects the path

Speed is the primary consideration



IGRP Configuration

Router IGRP command select IGRP as a rout

Router (config)# Router IGRP autonomous-system

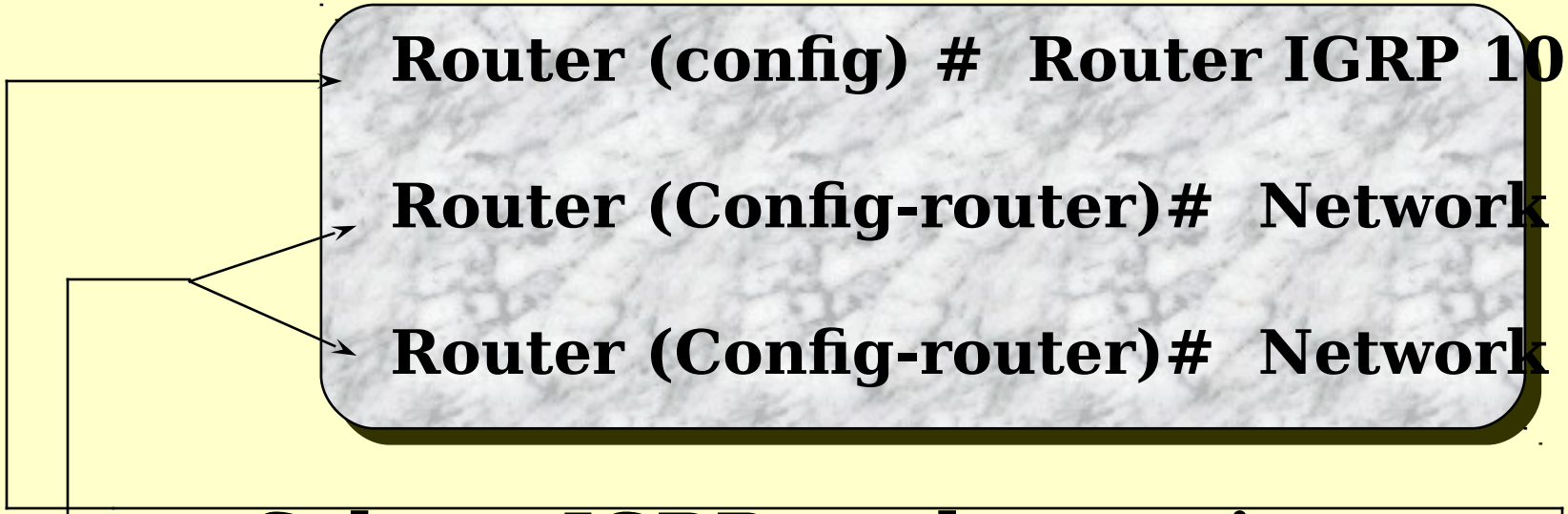
Identifies the IGRP router processes that shares routing i

The Network command specifies any directly connected networks to be included

Router (config-router) # Network network-numb

Specifies a directly connected network. A NIC network number, not a subnet number or individu

IGRP Configuration Example



Selects IGRP as the routing protocol for Autonomous System 109

Specifies a directly connected network

All interfaces connected to networks 1.0.0.0 and 2.0.0.0 will p

Routing IGRP

The “Network” command ensures that all the connected networks will participate in IGRP routing updates

“Show IP Protocol” command is used to display information about routing timers, filters, and network information

Routing IGRP cont

“Show IP Route” command is used to display contents of tables listing info about the networks, and sub networks, and to view the codes that show how the information was learned (RIP, IGRP)

- **ROUTER#show ip route**

Routing IGRP

Use the “**NO**” command from Global Mode to stop IGRP Routing

router(CONFIG)#NO ROUTER IGRP 20

Check on Learning

Why is the command sho ip route used?

To display routing tables, listing info about your networks, and sub networks.

What routing protocols are proprietary?

IGRP and EIGRP

Why is the Cisco Discovery protocol used?

CDP enables you to access a summary of the protocols and addresses configured on other Cisco devices.

Why do we use static routing?

When security is required or for stand alone routing to the outside world

P E # 4

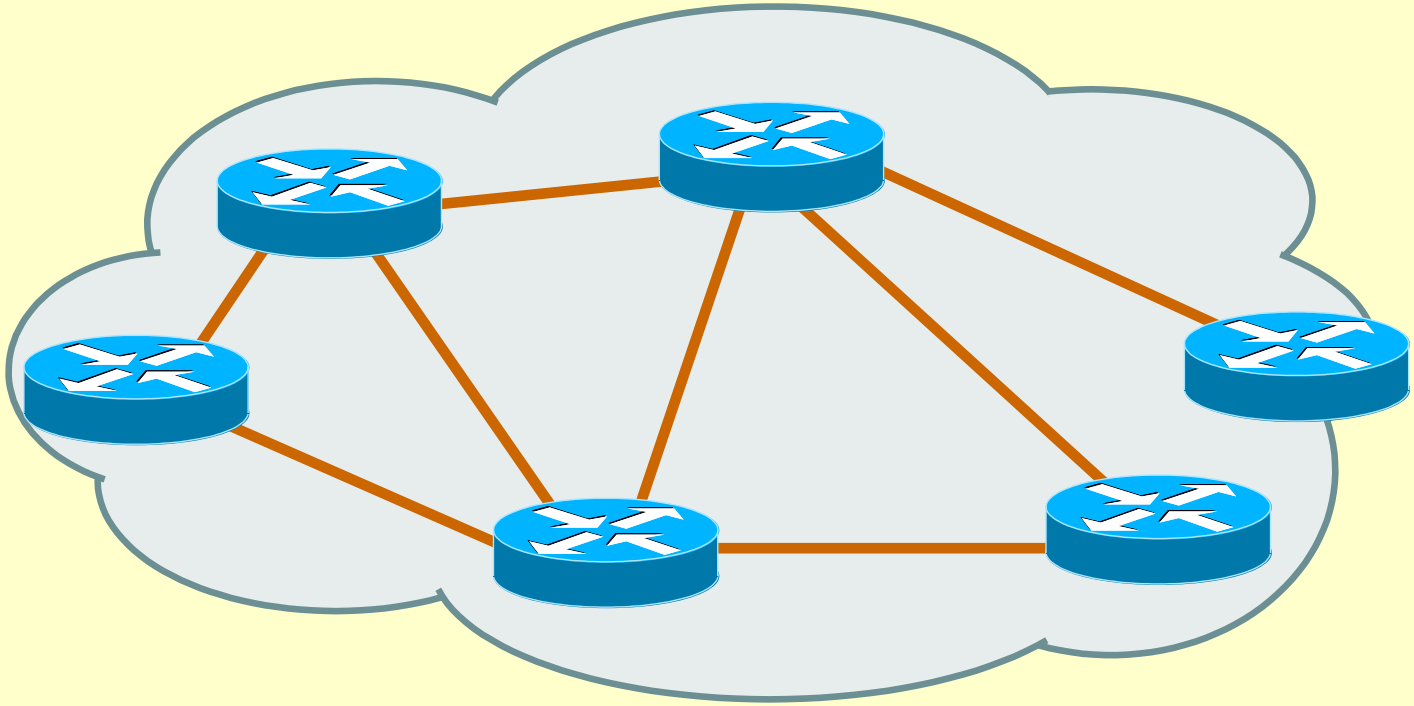
Configuring Serial Interfaces with

IGRP as the Protocol

OSPF FEATURES

- Open, non-proprietary
- Has no hop count limitation
- Uses multicast addressing for u
- Has fast convergence
- Allows for routing authenticati
- Supports hierarchical routing

An Autonomous System



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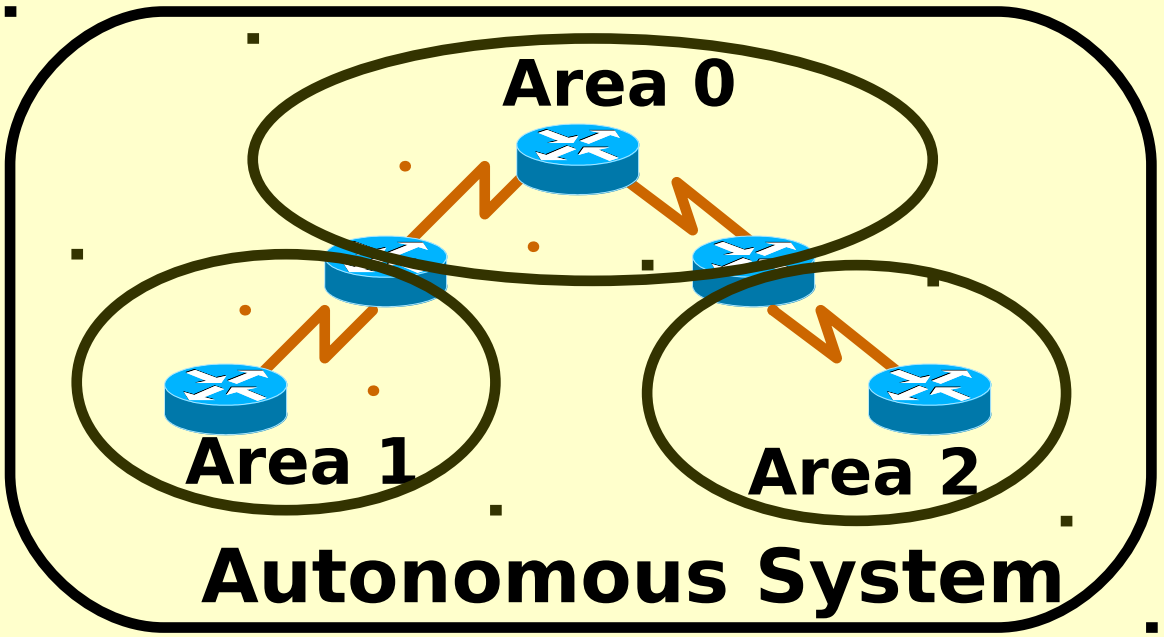
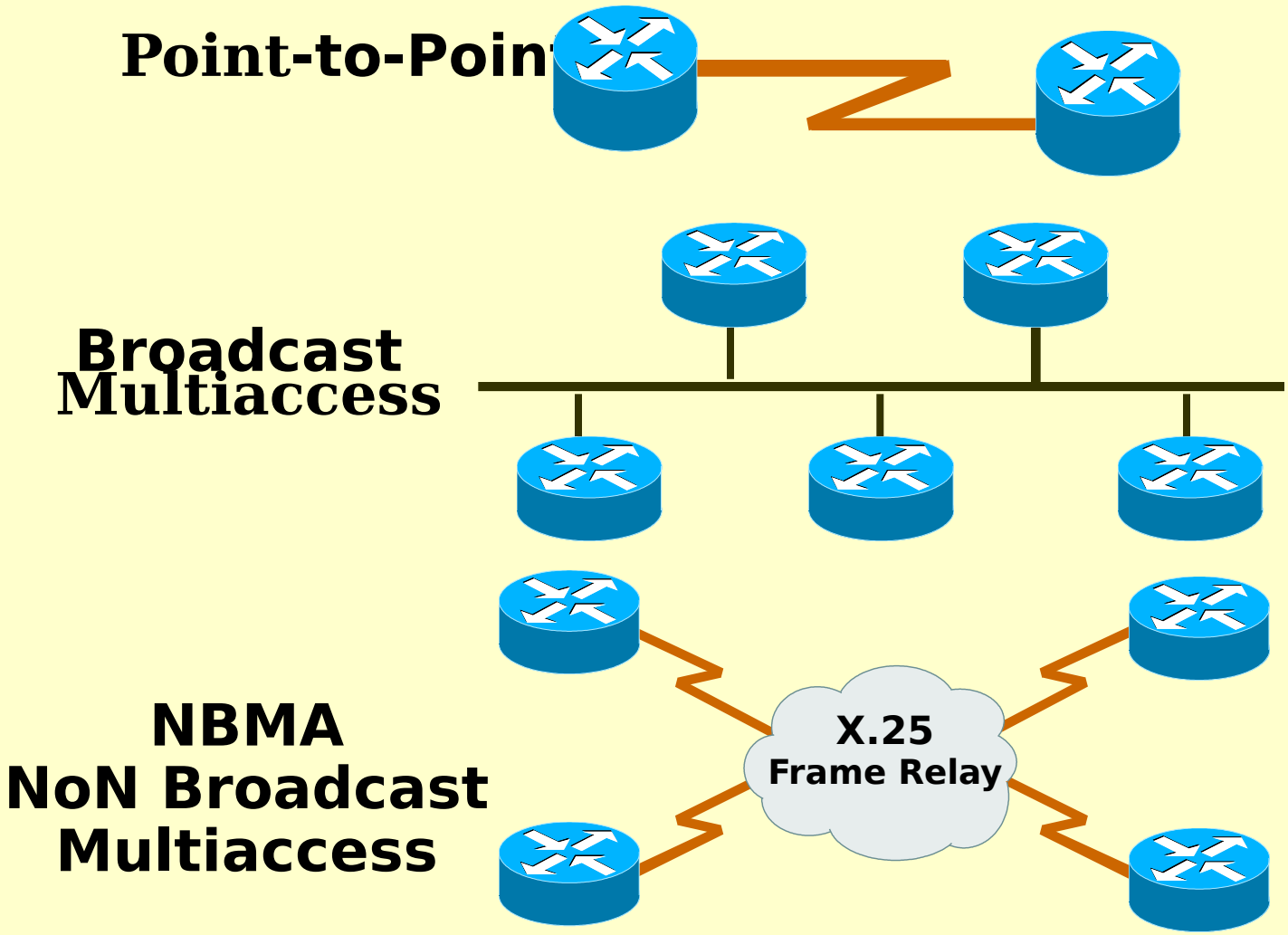
OSPF Hierarchical Routing



- Consists of areas within an autonomous system
- Minimizes routing update traffic

OSPF Network Types



ROUTING TABLE

- Calculated by running SPF Algorithm on LSA D
- Preferred routes placed in table
- All possible routes still stored in LSA DB

```
rtr3#sho ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
       U - per-user static route, o - ODR

Gateway of last resort is not set

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C       148.43.200.106/32 is directly connected, Serial1
B       148.43.200.20/30 [20/0] via 148.43.200.18, 06:47:45
C       148.43.200.18/32 is directly connected, Serial0
C       148.43.200.16/30 is directly connected, Serial0
B       148.43.200.28/30 [20/0] via 148.43.200.18, 04:06:19
```
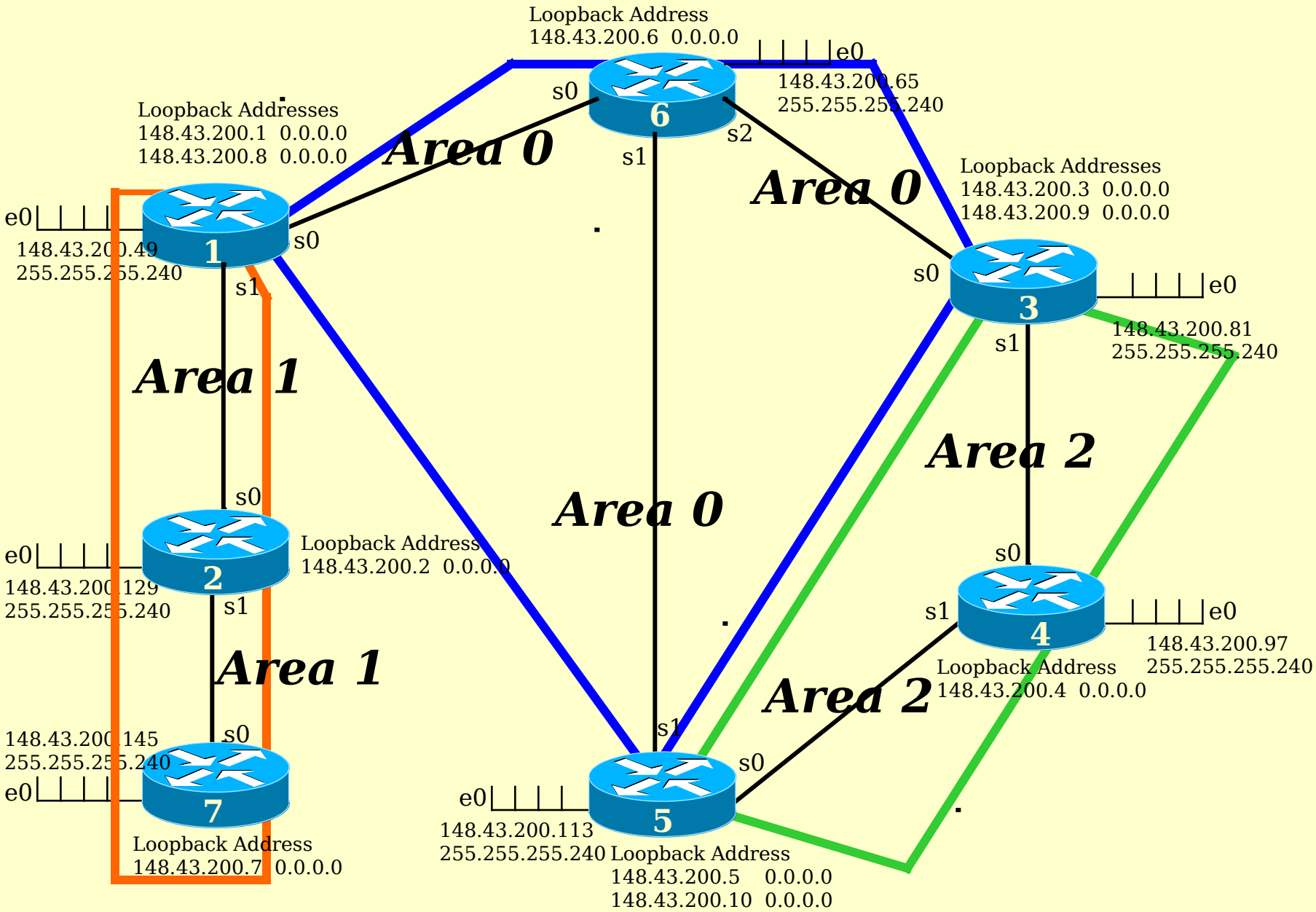

OSPF NETWORK DIAGRAM #1



How do I enable an OSPF Area?

```
Router>ena

Router#config t

Router (config)#router ospf 100

Router (config-router)# ^Z

Router# wr mem
```

How do I enable an OSPF neighbors?

Router>ena

Router#config t

Router (config)#router ospf 100

Router (config router)#network 192.56.73.0 0.0.0.255 area 1

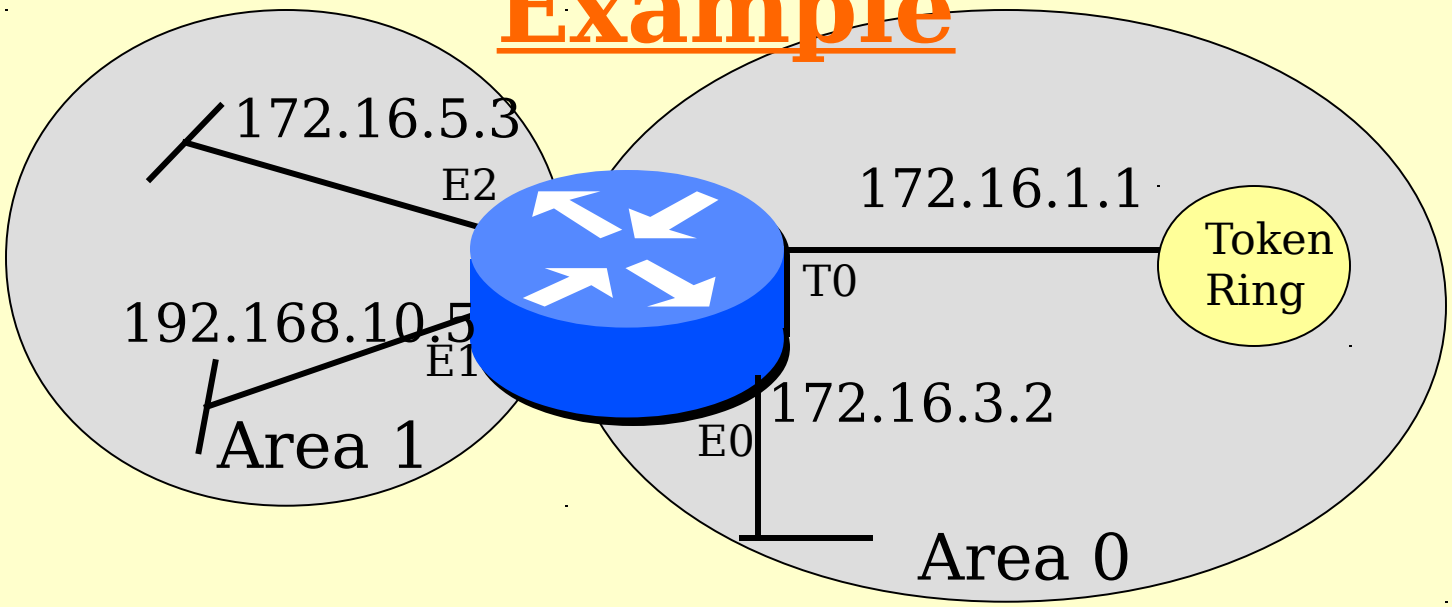
Router (config router)#network 172.16.30.0 0.0.0.255 area 2

Router (config router)#network 172.16.40.0 0.0.0.255 area 2

Router (config-router)# ^Z

Router# wr mem

OSPF Basic Configuration Example



Router ospf 63
network 172.16.5.3 0.0.0.0 area1
network 172.16.0.0 0.0.255.255 area 0
network 192.168.10.5 0.0.0.0

OSPF SHOW COMMANDS

- **Show IP OSPF Interface**
- **Show IP OSPF**

Show IP OSPF Neighbor Detail

- **Show IP OSPF Border-routers**

P E # 5

Configuring Serial Interfaces with

OSPF as the Protocol

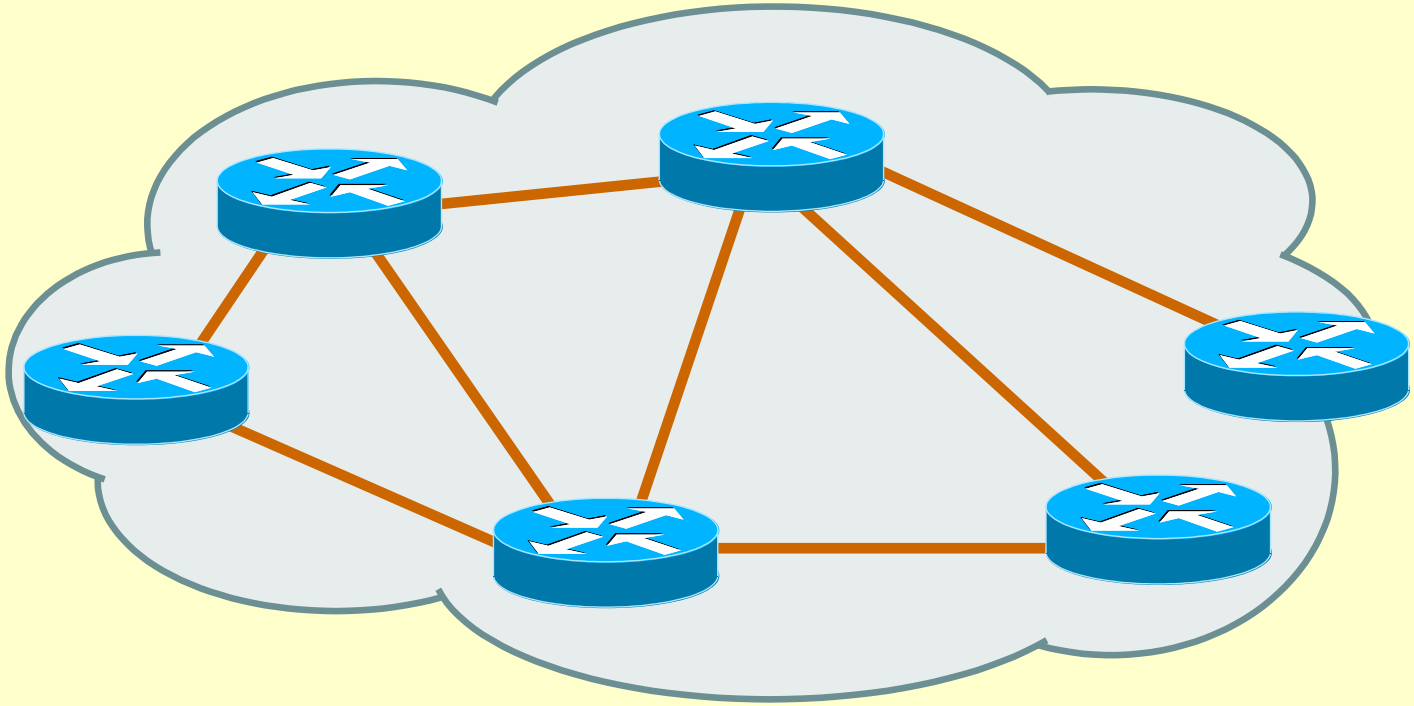
BGP-4

BORDER GATEWAY PROTOCOL 4

BGP Features.

- **Open, non-proprietary**
- **Allows for route summarizat**
- **Supports redistribution**

An Autonomous System



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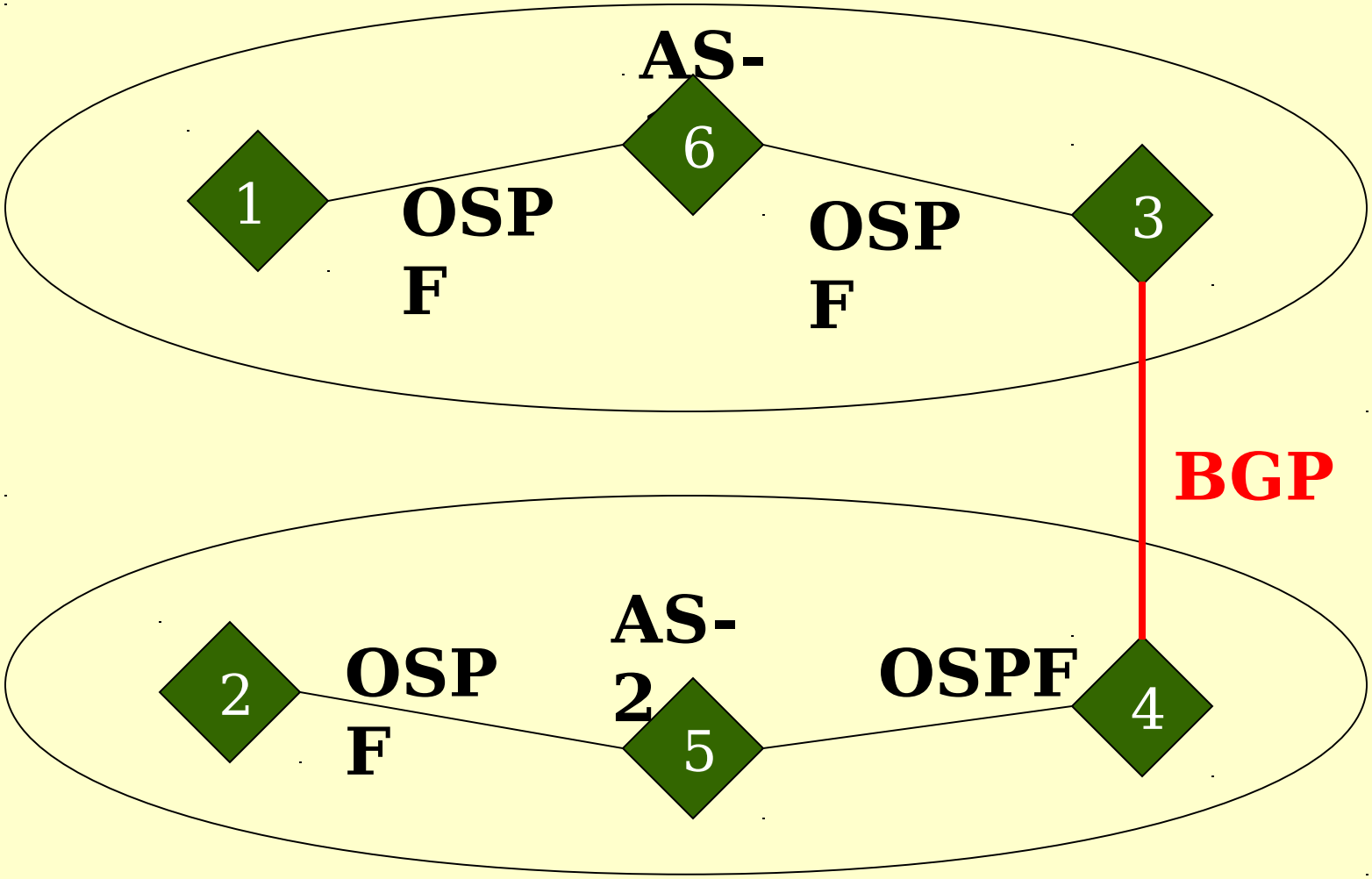
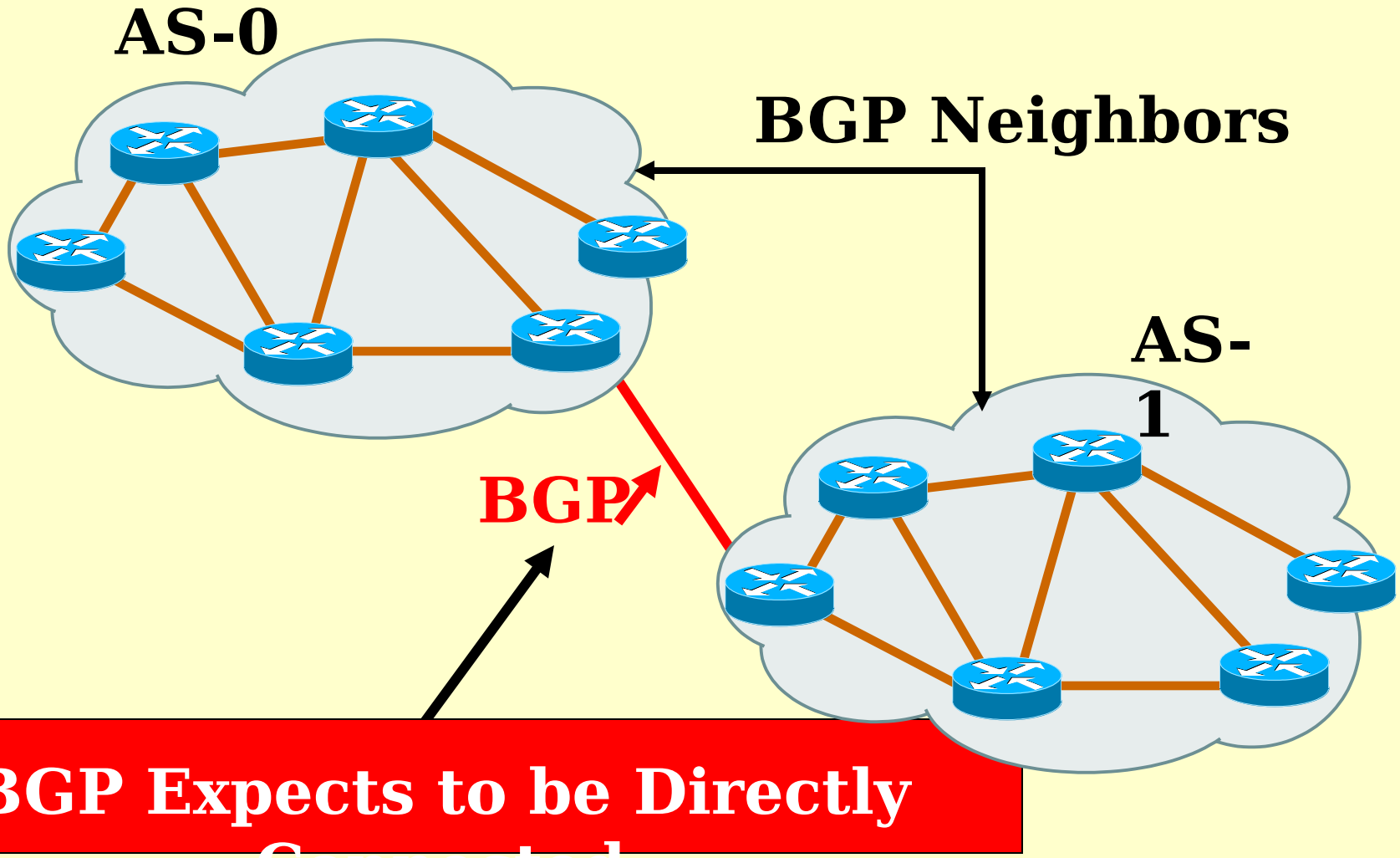
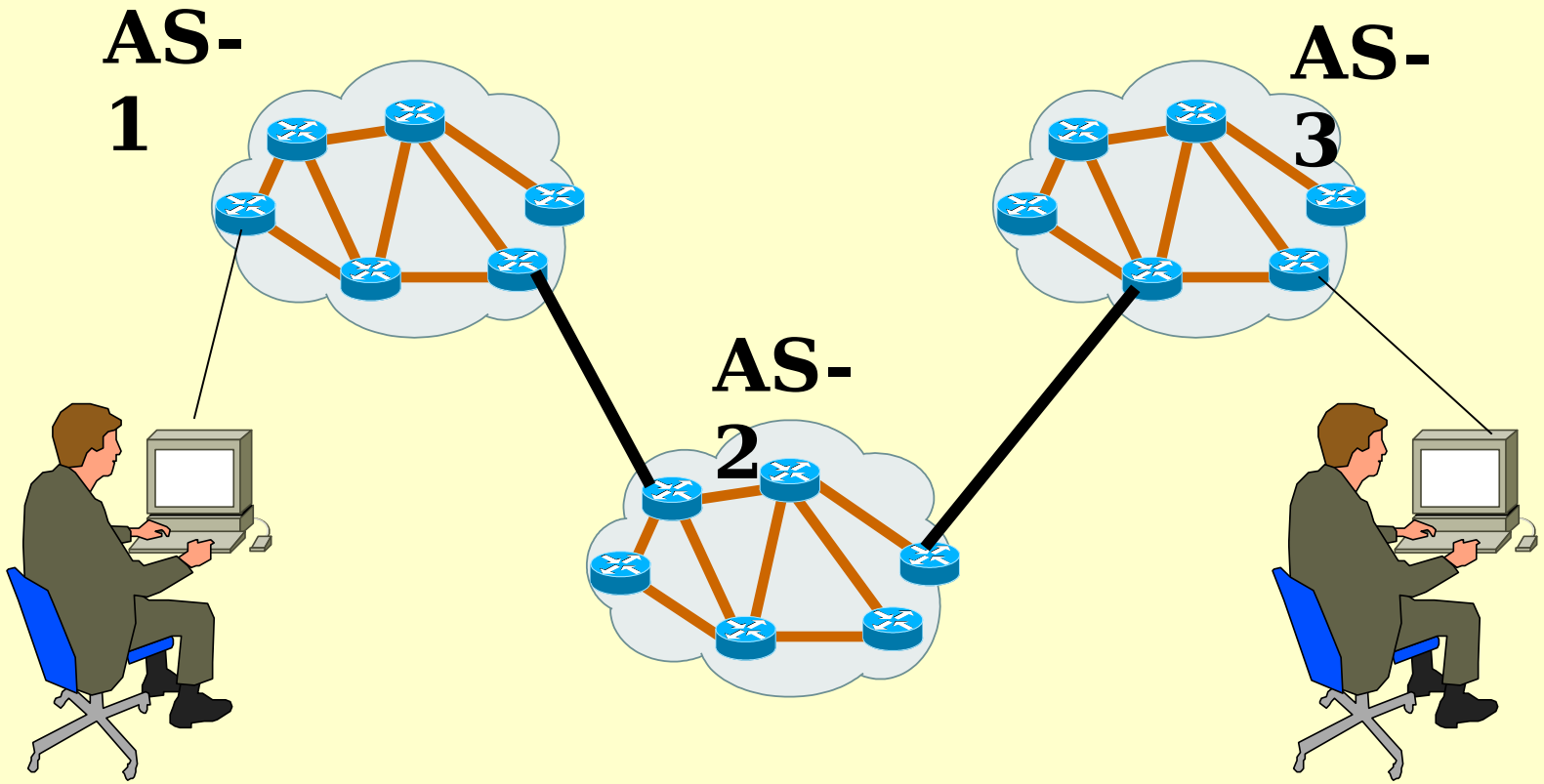
Interfacing two A.S.



Interfacing two A.S.



A Transit AS



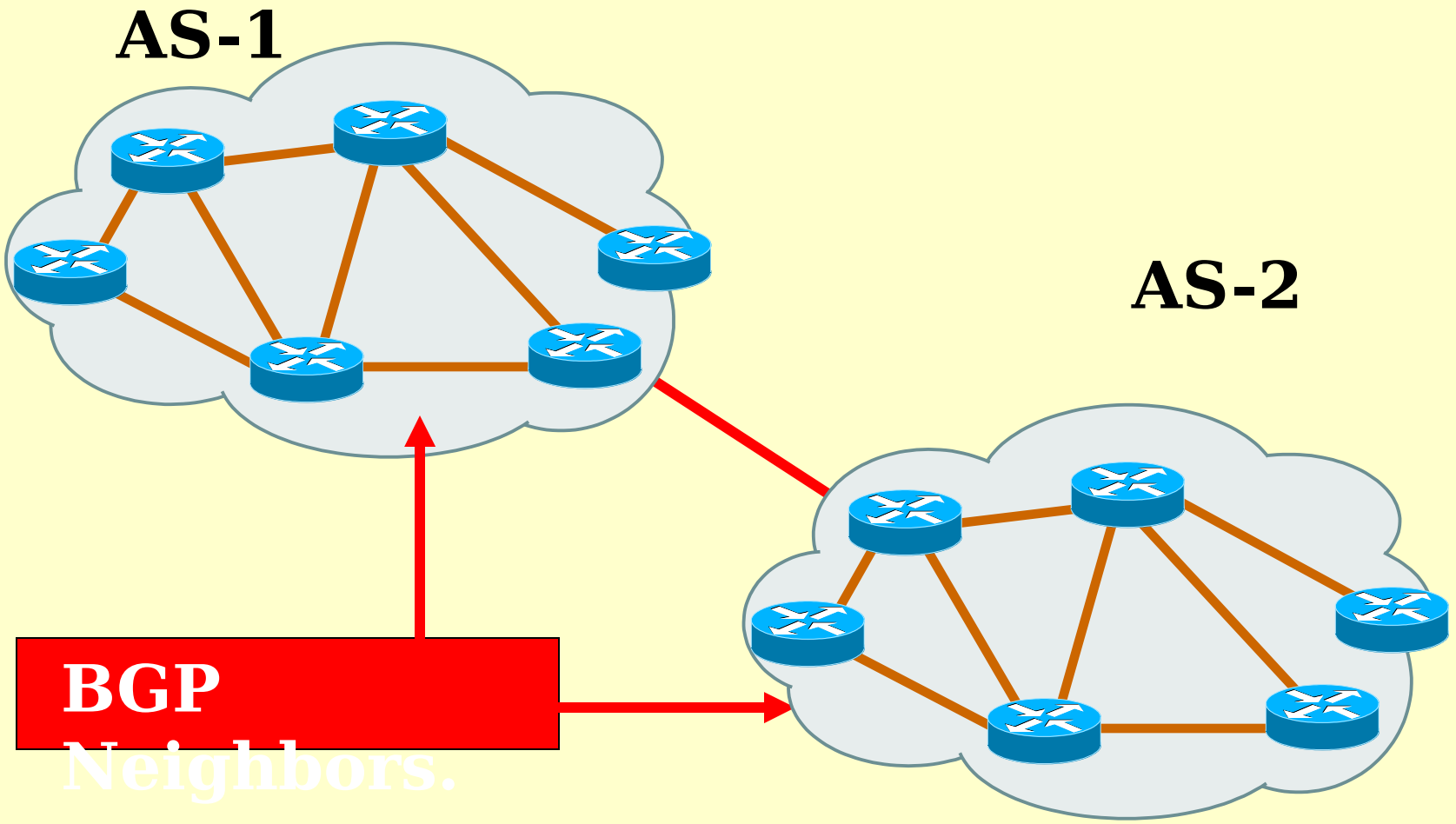
How do I enable BGP ?

```
Router> ena
Router# config t
Router (config) #router bgp autonomous-system
```

Autonomous-system

Identifies the local autonomous system

Identify your neighbors.



Neighbors

```
Router (config)# router bgp 2

Router (config-router)#network 172.16.0.0 mask
255.255.0.0

Router (config-router)#neighbor 172.16.12.2
remote as-1

Router (config-router)#redistribute static

Router (config-router)#exit

Router (config)#ip route 0.0.0.0 0.0.0.0 s0

Router (config)#^Z

Router#wr mem
```

The network command must include all networks you want to advertise, not just those locally connected.

Verifying it is working

Commonly used BGP commands.

- **sho ip bgp** — **Displays the BGP routing table**
- **sho ip bgp sum** — **Displays status of all BGP connections**
- **clear ip bgp *** — **Resets BGP connections**
- **sho ip route** — **Shows contents of ip routing table**

Sho ip bgp

PRIVILEGED EXEC - SHOW IP BGP

```
rtr3#sho ip bgp
BGP table version is 9, local router ID is 148.43.200.103
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete

     Network          Next Hop            Metric LocPrf Weight Path
*> 148.43.200.4/30    148.43.200.1                         0 4 2 i
*  148.43.200.16/30   148.43.200.18            0          0 4 i
*>                    0.0.0.0                  0      32768 i
*> 148.43.200.20/30   148.43.200.18            0          0 4 i
*> 148.43.200.24/30   148.43.200.18            0          0 4 i
*> 148.43.200.28/30   148.43.200.18                      0 4 5 i
*> 148.43.200.103/32  0.0.0.0                  0      32768 i
```

Sho ip bgp sum

PRIVILEGED EXEC - SHOW IP BGP SUMMARY

```
Router#sho ip bgp sum
BGP table version is 5, main routing table version 5
4 network entries (5/12 paths) using 832 bytes of memory
3 BGP path attribute entries using 300 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory

Neighbor        V    AS   MsgRcvd   MsgSent   TblVer  InQ  OutQ  Up/Down  State/PfxRcd
148.43.200.29   4     5       267       266        5    0     0  04:21:58            3
```

Sho ip route

PRIVILEGED EXEC - SHOW IP ROUTE

```
rtr3#sho ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
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C       148.43.200.16/30 is directly connected, Serial0
B       148.43.200.28/30 [20/0] via 148.43.200.18, 04:06:19
```

Check on Learning

Why should you run different OSPF areas in a Network?

To minimize routing updates

Why is the Border Gateway protocol used?

To connect networks together

What do BGP neighbors do?

Connect two different autonomous systems

What command is used to show the BGP routing table?

Sho ip bgp

P E # 6

Configuring Serial Interfaces with

BGP as the